

PRIZES TO SPUR INNOVATION AND TECHNOLOGY BREAKTHROUGHS

HEARING

BEFORE THE

SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRTEENTH CONGRESS

SECOND SESSION

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PRIZES TO SPUR INNOVATION AND TECHNOLOGY BREAKTHROUGHS

WEDNESDAY, APRIL 9, 2014

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to call, at 10:04 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Larry Bucshon [Chairman of the Subcommittee] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Subcommittee on Research and Technology

Prizes to Spur Innovation and Technology Breakthroughs

Wednesday, April 9, 2014
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Mr. Christopher Frangione, Vice President of Prize Development, XPRIZE

Mr. Donnie Wilson, Founder and CEO, Elastec American Marine

Mr. Narinder Singh, Co-Founder and Chief Strategy Officer, Appirio and President, TopCoder

Dr. Sharon Moe, President, American Society of Nephrology

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY**

HEARING CHARTER

Prizes to Spur Innovation and Technology Breakthroughs

Wednesday, April 9, 2014

10:00 a.m. - 12:00 p.m.

2318 Rayburn House Office Building

Purpose

On April 9, 2014, the Research and Technology Subcommittee will hold a hearing to examine the role of prizes funded by the private sector and Federal science agencies in spurring technical innovation. The FIRST Act (H.R. 4186) encourages more public-private partnerships for science and technology prize competitions, especially to spur breakthrough innovations that will spur new economic growth and jobs.

Witnesses

- **Mr. Christopher Frangione**, Vice President, Prize Development, XPRIZE Foundation
- **Mr. Donnie Wilson**, CEO, Elastec AmericanMarine
- **Mr. Narinder Singh**, Co-Founder and Chief Strategy Officer, Appirio and President, TopCoder
- **Dr. Sharon M. Moe**, MD, FASN, President-Elect, American Society of Nephrology.

Overview

Prize competitions have played an important role in spurring innovation. The Longitude Prize of £20,000 in the 1700s (approximately worth \$4 million today) was a reward offered by the British government for a simple and practical method for the precise determination of a sailing ship's longitude. The prize, established through an Act of Parliament (the Longitude Act) in 1714, was eventually awarded in 1765 to John Harrison for the development of the chronometer. The Orteig Prize of \$25,000 in 1927 (worth approximately \$340,000 today) inspired Charles Lindbergh to fly nonstop from New York to Paris, and spurred the American imagination for air travel. Inspired by the problems in cleaning up the damage caused by the Deepwater Horizon oil spill in 2009, the Wendy Schmidt Oil Cleanup X CHALLENGE of \$1 million demonstrated a technology that had more than four times the existing recovery rate for cleaning oil off the ocean's surface.¹

¹ Implementation of Federal Prize Authority: Fiscal Year 2012 Progress Report, Dec. 2013
http://www.whitehouse.gov/sites/default/files/microsites/ostp/competes_prizesreport_dec-2013.pdf

A McKinsey report in 2009² found that philanthropic and private-sector investment in prizes increased significantly in recent years; between 2000 and 2007, there was \$250 million in new prize money. In 1996, the X-Prize Foundation offered a \$10 million prize to the first privately-financed team that could build and fly a suborbital vehicle 100 km into space. The prize motivated 26 teams from seven nations to invest more than \$100 million, significantly more than the prize amount.

Federal science agencies have sponsored prizes to spur innovation for many years. The America COMPETES Reauthorization Act of 2010 (PL 111-358) granted all federal agencies broad authority to conduct prize competitions that spur innovation and advance their agency's core mission. Congress provided OSTP the responsibility to lay the policy and legal framework for agencies to take advantage of the prize authority. This authority has been utilized to a limited degree by a few federal science agencies. As many agencies expand their use of the authorities provided to them under COMPETES, some agencies have continued to administer prizes and challenges developed under other pre-existing authorities, including agency-specific authorities, grant-making authority, and procurement authority. However, the FIRST Act (H.R. 4186) encourages more federal-private prize competitions, especially prizes to spur breakthrough technologies leading to healthcare improvement, economic growth and the creation of new jobs.

Issues for Consideration

Though the federal prize authority was granted to agencies in 2010, some federal science agencies have taken a greater interest in utilizing prize authority to spur innovation. According to an Office of Science and Technology Policy (OSTP) report for prize activity released in December 2013, 27 prizes were conducted by seven federal science agencies. Some prize winners received cash prizes of a few thousand dollars to solve problems that did not have wide participation. In Fiscal Year 2013, the National Science Foundation (NSF) sponsored 7 prizes, with most cash awards less than \$10,000.

Another important policy issue concerns intellectual property. The majority of prize contests in recent years, such as the Qualcomm Tricorder XPRIZE³ and the Foresight Institute Feynman Grand Prize⁴, allow competitors to keep their intellectual property, except in limited circumstances. This combination of innovation prizes and intellectual property rights "reward the successful development of specific products," creating economic growth and innovation that may not have as readily occurred through only subsidized research.⁵ It is important to understand the policy implications of allowing innovators and entrepreneurs to continue utilizing the intellectual property that they create during these competitions.

² And the winner is...Capturing the promise of philanthropic prizes, March 2009
http://www.mckinseysociety.com/downloads/reports/Social-Innovation/And_the_winner_is.pdf

³ <http://www.qualcommtricorderxprize.org/competition-details/faqs#ip>

⁴ <https://www.foresight.org/GrandPrize.1.html>

⁵ <http://economics.mit.edu/files/7823>

Chairman BUCSHON. The Subcommittee on Research and Technology will come to order.

Good morning, everyone. Welcome to today's hearing entitled "Prizes to Spur Innovation and Technology Breakthroughs." In front of you are packets containing the written testimony, biographies, and truth-in-testimony disclosures for today's witnesses.

I now recognize myself for five minutes for an opening statement.

Earlier this year, our Subcommittee held a hearing about the scientific activities at the Smithsonian Institution. Curators from the Smithsonian brought the original check that was given to Charles Lindbergh for winning the Orteig Prize in 1927 when he flew non-stop from New York to Paris in his airplane "The Spirit of St. Louis." The Orteig prize—similar to prizes we will be discussing today—was a \$25,000 prize financed by a New York hotel owner to the first aviator to make the nonstop flight from New York to Paris. The impact of Lindbergh's flight was significant and helped spawn an interest in aviation and grow the emerging aviation industry.

Today, scientific prize challenges still play an important role in spurring innovation and the federal government and private sector are crucial to sustaining these challenges.

As a cardiothoracic surgeon, prize competitions in medical research are of particular interest to me. Rising healthcare costs are becoming a burden to American families. One example where cost containment is crucial affects the 450,000 Americans who suffer from end-stage renal disease, commonly known as kidney failure. One of our witnesses today, Dr. Sharon Moe who comes to us from the Indiana University School of Medicine, will discuss the effects a prize competition in kidney innovation to find cost-effective alternatives to transformative dialysis might have on the disease.

Last month, I introduced H.R. 4186, the Frontiers in Innovation, Research, Science, and Technology—or FIRST—Act. The FIRST Act contains language that will provide the guidance necessary to help make this and other potential prizes come to fruition. We must ensure federal investment is also leveraging private sector investment in prize competitions.

Our witnesses today will showcase some of the important efforts that are currently underway and we will be hearing from a major prize organization, a prize winner, a crowd-source prize expert, and a prize proposer. I got that all out. I hope that the work from these witnesses will inspire and produce the next Charles Lindbergh, transform fields, and develop important technological breakthroughs.

I look forward to hearing from our distinguished witnesses and having a productive discussion.

[The prepared statement of Mr. Bucshon follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON CHAIRMAN LARRY BUCSHON

I am pleased to call to order this morning's Subcommittee on Research and Technology hearing that will examine prizes funded by both the private sector and the federal government to spur innovation and technology breakthroughs.

Earlier this year, our subcommittee held a hearing about the scientific activities at the Smithsonian Institution. Curators from the Smithsonian brought the original check that was given to Charles Lindbergh for winning the Orteig Prize in 1927 when he flew non-stop from New York to Paris in his airplane "The Spirit of St.

Louis.” The Orteig prize -similar to the prizes we will be discussing today- was a \$25,000 prize financed by a New York hotel owner to the first aviator to make the non-stop flight from New York City to Paris. The impact of Lindbergh’s flight was significant and helped spawn an interest in aviation and grow the emerging aviation industry.

Today, scientific prize challenges still play an important role in spurring innovation and the federal government and private sector are crucial to sustaining these challenges.

As a cardio thoracic surgeon, prize competitions in medical research are of particular interest to me. Rising healthcare costs are burdening to American families. One example where cost containment is crucial affects the 450,000 Americans who suffer from End-Stage Renal Disease (ESRD), commonly known as kidney failure. One our witnesses today, Dr. Sharon Moe who comes to us from the Indiana University School of Medicine, will discuss the effects a prize competition in kidney innovation to find cost effective alternatives to transformative dialysis might have on the disease.

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I look forward to hearing from our distinguished witnesses and having a productive discussion.

Chairman BUCSHON. At this point, I now recognize the Ranking Member, the gentleman from Illinois, Mr. Lipinski, for an opening statement.

Mr. LIPINSKI. Thank you, Mr. Chairman. Thank you for holding this hearing and I thank our witnesses for being here this morning.

Prize challenges inspire and help spur technological advancement by tapping into the strength of American ingenuity, and both the public and private sectors are increasingly making use of this tool to accelerate innovation. Recent prize competitions have challenged inventors to build fuel-efficient vehicles, develop technology to clean up oil spills, and to create algorithms for faster mobile applications. Prize competitions, including the one that the Chairman mentioned, spurred Charles Lindbergh to make the first nonstop transatlantic flight. It can also be credited with producing breakthroughs in aviation, navigation, food preservation, and many other advances in the modern world.

For years, I have been a strong supporter of using prizes to incentivize advancement of emerging technologies, so I like to feel I was on the cutting-edge here in Congress on this issue. In 2007, I introduced the H-Prize Act along with a Republican colleague on this Committee, and that bill was incorporated into the Energy Independence and Security Act, which became law. And actually that originally was introduced in Congress before that in 2005.

So that language that got incorporated into the bill authorized the Department of Energy to conduct prize challenges for the development of hydrogen as a transportation fuel. In 2010, I put language in the House NSF Reauthorization Bill giving prize competition authority to that agency. And the final version of COMPETES contained prize authority for all federal agencies. I am glad to know that in Fiscal Year 2012 several agencies conducted 27 prize competitions under this authority. I would also add that DOE is

taking another look at hydrogen energy, and I am hopeful that this will involve a new prize competition using these authorities to supplement the current work.

With today's budget climate, the federal government has to consider alternative financing tools for R&D funding outside of the established research grant paradigm in order to meet research goals. One benefit of prize challenges is that the prize is awarded only once the challenge has been met. This allows agencies to incentivize high-risk, high-reward research that generally constitutes a very small percentage of federally funded research. Prize competitions also attract participants who do not typically seek government grants or contracts. This brings in a diversity of ideas from people of different disciplines and educational backgrounds and levels.

I would be interested in hearing from the witnesses about how their organizations encourage competitors to take advantage of this diversity and to learn from their peers. Also, I would be interested to hear how the witnesses reach out to students to encourage a culture of science learning through prize competitions.

Fundamentally, the federal government supports scientific and technological breakthroughs with sustained investments in basic research. Prize competitions cannot replace our tried and true model for funding R&D but they can serve as another tool in the toolbox. I am looking forward to hearing from our witnesses what they have learned in designing and participating in competitions and how the federal government might further collaborate with these types of organizations so we can continue as leaders in innovation.

I want to thank all of our witnesses for being here. I look forward to their testimony.

Thank you, Mr. Chairman, and with that I yield back.

[The prepared statement of Mr. Lipinski follows:]

PREPARED STATEMENT OF SUBCOMMITTEE RANKING MINORITY MEMBER DAN LIPINSKI

Mr. Chairman, thank you for holding this hearing, and thank you to our witnesses for being here this morning.

Prize challenges inspire and help spur technological advancement by tapping into the strength of American ingenuity, and both the public and private sectors are increasingly making use of this tool to accelerate innovation. Recent prize competitions have challenged inventors to build fuel efficient vehicles, develop technology to clean up oil spills, and to create algorithms for faster mobile applications. Prize competitions, including the famous 1927 Orteig Prize that spurred Charles Lindberg to make the first non-stop transatlantic flight, can be credited with producing breakthroughs in aviation, navigation, food preservation and many other advances in the modern world.

For years, I have been a strong supporter of using prizes to incentivize advancement of emerging technologies. In 2007, I introduced the H-Prize Act along with a Republican colleague on this Committee and that bill was incorporated into the Energy Independence and Security Act which became law. My bill authorized the Department of Energy to conduct prize challenges for the development of hydrogen as a transportation fuel. In 2010 I put language in the House NSF reauthorization bill giving prize competition authority to that agency and the final version of the COM-PETES Reauthorization contained prize authority for all federal agencies. I am glad to know that in fiscal year 2012 seven agencies conducted 27 prize competitions under this authority. I would also add that DOE is taking another look at hydrogen energy, and I am hopeful that this will involve a new prize competition using these authorities to supplement their current work. With today's budget climate the Fed-

eral Government has to consider alternative financing tools for R&D funding outside of the established research grant paradigm in order to meet research goals.

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This brings in a diversity of ideas from people of different disciplines and educational backgrounds and levels. I would be interested in hearing from the witnesses about how their organizations encourage competitors to take advantage of this diversity and to learn from their peers. Also, I would be interested to hear how the witnesses reach out to students to encourage a culture of science learning through prize competitions. Fundamentally, the federal government supports scientific and technological breakthroughs with sustained investments in basic research. Prize competitions cannot replace our tried and true model for funding R&D, but they can serve as another tool in the toolbox. I am looking forward to hearing from our witnesses what they have learned in designing and participating in competitions, and how the federal government might further collaborate with these types of organizations so that we can continue as leaders in innovation.

I want to thank all of the witnesses for being here, and I look forward to their testimony. Thank you Mr. Chairman, I yield back.

Chairman BUCSHON. Thank you, Mr. Lipinski.

I now recognize the Chairman of the full Committee, the gentleman from Texas, Mr. Smith.

Chairman SMITH. Thank you, Mr. Chairman.

Scientific prizes have long played a role in advancing technology. They encourage creative thinking, spur innovation, and expand our economy. The Longitude Prize of 1714, offered by the British Government, resulted in the marine chronometer and drastically improved shipping safety. Napoleon Bonaparte's 1800 Food Preservation Prize resulted in the development of canning food as we now know it.

A top priority of the Science Committee is to encourage such innovation and technological advancements. To maintain our competitive advantage, we must continue to support fundamental research and development that encourages the creation and design of next generation technologies. But there are many other technological problems that could be solved by taking a different approach with the use of prizes. These include transforming kidney dialysis treatments, developing better surface oil cleanup technologies, and generating a potential cure for Alzheimer's disease. Prizes also engage the brightest minds to solve a problem—scientists, entrepreneurs, inventors and yes, even teenagers.

A great example of creative problem solving was illustrated recently when a 14-year-old student in Pennsylvania came up with a simple way to save the federal government hundreds of millions of dollars. He figured out that by changing the type of font used by government workers, the federal government could save more than \$130 million each year. This great idea was the product of a science fair.

Prizes also encourage individual incentive so the burden of risk, as well as the opportunity for success, is on the team or individual competitor. This will encourage more people to engage in high-risk, high-reward research.

Federal science agencies have not fully utilized their prize competition authority to pursue breakthroughs in areas such as healthcare, advanced manufacturing, and agriculture. The FIRST Act improves federal science prize authority. It allows federal

science agencies to better partner with the private sector to maximize the value of every taxpayer dollar invested in research and development.

In the words of one witness, Mr. Christopher Frangione, "Policy-makers can continue this great progress in prize-based, public-private partnerships by supporting prize language such as that included in the FIRST Act."

Mr. Chairman, I do want to thank our witnesses for being here today. I want to thank them for their excellent written testimony, which I have seen, and apologize to them. I have to give a speech at 10:30 over in the Capitol so I am going to have to excuse myself.

But let me just say in conclusion that I think there is much progress we can make in giving out these prizes. For instance, the National Science Foundation I think last year only awarded seven for \$10,000 each. That is not really stepping up to the level that we would like to see them do, for example.

And there are other ways that we can encourage individuals to participate and there are other ways that we can encourage government agencies to offer these prizes as well. They just do an immense amount of good. I remember in one instance—and I forget; maybe it had to do with the flying prize—where individuals actually spent 10 times more than the prize trying to get the prize just because it was sort of natural competitive instincts because of a desire to try to achieve a breakthrough and perhaps even be successful on the profit side as well. So prizes do a lot of good in a lot of ways.

Thank you, Mr. Chairman, and I yield back.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF FULL COMMITTEE CHAIRMAN LAMAR S. SMITH

Thank you, Chairman Bucshon, for holding today's hearing.

Scientific prizes have long played a role in advancing technology. They encourage creative thinking, spur innovation and expand our economy.

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The FIRST Act improves federal science prize authority. It allows federal science agencies to better partner with the private sector to maximize the value of every taxpayer dollar invested in research and development.

In the words of one witness, Mr. Christopher Frangione, "Policymakers can continue this great progress in prize-based, public-private partnerships by supporting prize language such as that included in the FIRST Act."

I thank our witnesses for being here this morning and I look forward to their testimony.

Chairman BUCSHON. Thank you, Mr. Chairman. I now recognize the Ranking Member of the full Committee, the gentlelady from Texas, Ms. Johnson.

Ms. JOHNSON. Thank you very much and good morning. Thank you for holding this hearing to explore the use of prize competitions to spur innovation and technology breakthroughs.

We are all very aware of the economic climate and budget constraints that the nation is facing. While tough choices have to be made, cuts to our federal R&D enterprise weakens the country's ability to be a leader in innovation. Our competitors have the same tough budget choices to make, yet they are not just maintaining their R&D investments but doubling and tripling them. Though they are no substitute for the sustained investment and long-term national outlook that traditional federal R&D funds provide, prize competitions could play a more prominent role in how the government funds R&D than they have in the past.

The broad federal prize authority granted to all federal agencies in the 2010 COMPETES reauthorization supports agencies' increased use of prizes to incentivize more high-risk, high-reward research and reach out to a new audience of researchers and innovators across all areas of science and technology. NASA has established itself as a leader in public sector prize competition. In a survey of nearly 3,000 competitors for NASA prizes, 81 percent reported that they had never before responded to NASA or other government requests for proposals.

And we ought to pull ahead of the competition. We must create opportunities for creative minds from all corners of our nation to make the next scientific or technological breakthrough. Prize competitions are yet another effective tool to tap into our Nation's brain power.

Two of our witnesses here today have spent years perfecting the design of prize competitions, and I am interested in learning how they develop specifications and parameters for challenges while still encouraging what may seem to be the pie-in-the-sky ideas.

Henry Ford once said, "If I had asked people what they wanted, they would have said faster horses." Finding the next Model T is critical to our Nation's competitiveness, and I look forward to exploring how public-private collaborations and prize competitions might help.

I thank our witnesses for being here, for their testimony, and thank you, Mr. Chairman. I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF FULL COMMITTEE
 RANKING MEMBER EDDIE BERNICE JOHNSON

Good morning, I would like to thank the Chairman for holding today's hearing to explore the use of prize competitions to spur innovation and technology breakthroughs.

We are all very aware of the economic climate and budget constraints that the nation is facing. While tough choices have to be made, cuts to our federal R&D enterprise weaken the country's ability to be a leader in innovation. Our competitors have the same tough budget choices to make, yet they are not just maintaining their R&D investments, but doubling and tripling down.

Though they are no substitute for the sustained investment and long-term national outlook that traditional federal R&D funding provides, prize competitions could play a more prominent role in how the government funds R&D than they have in the past. The broad federal prize authority granted to all federal agencies in the 2010 COMPETES Reauthorization supports agencies' increased use of prizes to incentivize more high-risk, high-reward research and reach out to a new audience of researchers and innovators across all areas of science and technology.

NASA has established itself as a leader in public-sector prize competitions. In a survey of nearly 3,000 competitors for NASA prizes, 81% reported that they had never before responded to NASA or other government requests for proposals. If we are to pull ahead of the competition, we must create opportunities for creative minds from all corners of our nation to make the next scientific or technological breakthrough. Prize competitions are yet another effective tool to tap into our nation's brainpower.

Two of our witnesses here today have spent years perfecting the design of prize competitions, and I am interested in learning how they develop specifications and parameters for challenges while still encouraging what may seem to be "pie-in-the-sky" ideas. Henry Ford once said, "if I had asked people what they wanted, they would have said faster horses." Finding the next Model T is critical for our nation's competitiveness, and I look forward to exploring how public-private collaborations in prize competitions might help. I thank our witnesses for their testimony.

Thank you Mr. Chairman, I yield back.

Chairman BUCSHON. Thank you, Ms. Johnson.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this time.

At this time I would like to introduce our witnesses. Our first witness today is Mr. Christopher Frangione, the Vice President of Prize Development at XPRIZE. In his role, Mr. Frangione works with all departments of XPRIZE, prize sponsors, and other prize stakeholders to develop prize strategy. Prior to joining XPRIZE, Mr. Frangione ran a market assessment practice at a boutique management consulting firm where he consulted to CEOs of major engineering companies on issues related to strategy. Mr. Frangione has leadership experience across the energy industry, including serving as Manager of Operations and Business Development at Green Mountain Energy Company. In that role, he managed a regional market and defined new business opportunities, policies, and strategies for the retail renewable energy company. Mr. Frangione received his bachelor of arts in environmental policy from Colby College and a master's of business administration and a master's of environmental management from Duke.

Our second witness today is Mr. Donnie Wilson, Chairman and CEO of Elastec/American Marine, one of the largest manufacturers of pollution control products in the world, exporting equipment to over 100 countries. Mr. Wilson has over 20 years of experience in the design and production of oil spill products. Mr. Wilson has provided training and supervision to global clients for the collection and recovery of oil spills. Mr. Wilson served as the lead onsite burn

coordinator during the Deepwater Horizon oil spill in the Gulf of Mexico in 2010, supervising more than 400 offshore controlled burns. During the spill, there was a void in mechanical equipment to recover high volumes of oil, prompting the Wendy Schmidt Oil Cleanup X Challenge. Elastec/American Marine won with its patented groove disc skimmer winning the \$1 million first-place prize out of 350 global entrants. Welcome.

Our third witness today is Mr. Narinder Singh. As the President of the [topcoder] community and Chief Strategy Officer at Appirio, Mr. Singh is responsible for overseeing the company's strategy, technology, and crowdsourcing initiatives. A co-founder of Appirio, Mr. Singh brings nearly 20 years of software and business experience and plays a role in keeping Appirio at the forefront of cloud, social, and mobile technology. Prior to joining Appirio—am I pronouncing that correctly—Mr. Singh worked in the office of the CEO as a part of a corporate strategy group. However, he began his career with Accenture at Center for Strategic Technology. Mr. Singh holds a bachelor of science from Northwestern University and an MBA from the Wharton School. He has won numerous awards for business and technology leadership, including the San Francisco Business Times 40 under 40 in 2013.

And our final witness is Dr. Sharon Moe, President-elect of the American Society of Nephrology and a Stuart A. Kleit Professor of Medicine at the Indiana University School of Medicine. She is also a Division Director for Nephrology in the Department of Medicine at Indiana University School of Medicine and Section Chief for Nephrology at their Roudebush VA Medical Center. Dr. Moe is the principal investigator for several ongoing clinical and basic research studies in the field of vascular calcification and bone and mineral metabolism and kidney disease. Her research is funded by the Veterans Affairs Department, the National Institutes of Health, and pharmaceutical companies. She has authored over 140 scientific manuscripts, teaching manuscripts, and textbook chapters. Dr. Moe received her medical degree from the University of Illinois College of Medicine in Chicago in 1989, as I did in 1984. She completed her internship and residency at the Department of Internal Medicine at Loyola University Medical Center in Maywood, Illinois.

Thanks again for all our witnesses for being here this morning. It is a pleasure to have you.

As our witnesses should know, spoken testimony is limited to five minutes each, after which the Members of the Committee will have five minutes each to ask questions.

I now recognize Mr. Frangione for five minutes to present his testimony.

**TESTIMONY OF MR. CHRISTOPHER FRANGIONE,
VICE PRESIDENT OF PRIZE DEVELOPMENT, XPRIZE**

Mr. FRANGIONE. Thank you. Thank you to the Committee, Ranking Members and Chairman, for the opportunity to testify today. And we welcome at XPRIZE the attention that the Committee is giving prizes as an economically efficient tool to incentivize innovation.

XPRIZE is a 501(c)(3) nonprofit organization founded in 1995 and we are the global leader in prize competitions. Our mission is to bring about radical breakthroughs for the benefit of humanity and to inspire the formation of new industries and to revitalize broken industries or stuck industries.

To date, we have awarded four prizes worth over \$23 million, including our \$10 million Ansari XPRIZE for suborbital spaceflight, and we have four active prizes worth over \$44 million, including a handheld health diagnostic to diagnose 15 disease states and vital signs, the Qualcomm Tricorder XPRIZE. And in most of these competitions, we collaborated with the U.S. Government, whether it be in a financial mechanism or just in a partnership.

As you have heard from everybody's statements already, prizes are powerful tools for innovation. And, as Ranking Member Lipinski said, you know, the most important of which include leveraging your investment, democratizing innovation, and reducing risk. And if you look at leveraging your investment, you heard it up there earlier, but if you put out a \$5 million grant, you are going to get \$5 million worth of work. In a prize competition, the teams are spending their own money to compete, so if you put out a \$5 million prize, you expect to get \$20–50 million worth of work. In a time of fiscal constraint, this is a huge benefit.

In terms of democratizing innovation, a prize does not care if somebody has had 20 years of experience or 20 days of experience as long as they can accomplish the goal you set out. And, most likely, you would have never given a grant or contract to these people that are competing for our competitions because 1) it would have been too risky for you; 2) you would have gone to your known solver community; 3) you would have never known they existed; and 4) they didn't know they were interested in competing. They didn't know they had the expertise.

And somebody brought up the question of high school students. We actually had a group of high school students in our Progressive Insurance Automotive XPRIZE and we have a group of high school students in that Qualcomm Tricorder XPRIZE, that handheld health diagnostic.

And in terms of reducing risk, prizes are great in that they only pay the winner. So you put out a prize purse and these people are competing against each other to achieve that prize, so they are willing to take huge risks that really lead to disruptive innovations, risks that the people that you are going to give your normal grants or contracts to are not going to take because they don't want to let you down and you don't want them to take because you are on the hook for all the money.

So we say at XPRIZE that the impact does not begin at the launch of the prize but at its award and that we want to make it extremely simple and rewarding for teams to compete. So we focus heavily on marketing and education. We focus heavily on recruiting teams and we focus heavily on supporting those teams so that they can all enter the marketplace at the end of the competition and be successful and change the world.

In terms of private-public partnerships, we believe that they are the key to success in prize competitions. One example in one of our competitions in that Qualcomm Tricorder XPRIZE where we have

actually partnered with the FDA, and it is not a financial partnership. The FDA is assisting teams in preparing for future regulatory clearance for post-competition while the prize competition is actually helping the FDA maximize its own readiness for new regulatory submissions in the direct-to-consumer medical marketplace. And that is great. We also partnered with the Department of Energy in our Progressive Insurance Automotive XPRIZE. That was a financial partnership where they gave us \$10 million to help support the competition.

We believe that the private and public sectors must work together to utilize every tool available. As you heard up there, tools are not—prizes are not the solution; they are one tool in the innovation toolkit that complements the other tools we have. And understanding how and when prizes work will ensure that they are used most effectively and efficiently.

The federal government, since 2010, not only under America COMPETES but more broadly, has launched 300 competitions through 55 agencies. And in 2012—or, excuse me, 2013, 25 agencies self-reported a total of 87 prizes, which is an 85 percent increase year-over-year.

Congress can use policy as a driver for innovation by including language that you have in your current bill, supportive of prizes, and we believe that that language sends a strong signal to federal agencies and also the private sector that prizes are a good innovation tool.

So we look forward to continuing the dialogue with the Committee and Congress as a whole about the power of prizes. Thank you.

[The prepared statement of Mr. Frangione follows:]

Testimony of

Christopher Frangione
Vice President, Prize Development, XPRIZE

Before the
United States House of Representatives
Committee on Science, Space and Technology
Subcommittee on Research and Technology

“Prizes to Spur Innovation and Technology
Breakthroughs”

April 9, 2014

Introduction

On behalf of XPRIZE, I'd like to thank the committee, Chairman Buschon and Ranking Member Lipinski, for the opportunity to testify today. XPRIZE welcomes the attention the committee is giving to prizes as an economically efficient way for the Federal government to incent innovation, economic growth and solutions to some of the biggest problems facing our nation today. I'm Chris Frangione, Vice President of Prize Development. I am responsible for overseeing the design of XPRIZES from conception to launch.

Background

XPRIZE is the global leader in the creation of incentivized prize competitions. As a 501(c)(3) not-for-profit organization, our mission is to bring about radical breakthroughs for the benefit of humanity, thereby inspiring the formation of new industries and the revitalization of markets. XPRIZE works to accelerate the pace of innovation across sectors with prizes that are audacious, yet achievable. XPRIZE looks across industries to find "white spaces" where a breakthrough can lead to an exponential shift.

Founded in 1995, we are the recognized world leader for creating and managing large-scale, global, incentive prize competitions that stimulate investment in research and development worth far more than the prize itself. To date, XPRIZE has successfully awarded four prizes with combined purses of over \$23 million. These prizes covered multiple sectors, including Progressive Insurance Automotive XPRIZE for highly fuel-efficient vehicles, the Wendy Schmidt Oil Cleanup XCHALLENGE for better surface oil cleanup technologies, the Northrop Grumman Lunar Lander XCHALLENGE, and of course the Ansari XPRIZE for commercial space flight. In most of these competitions we collaborated with the U.S. government.

We also have four active prizes with combined purses of over \$44 million. These include the \$30 million Google Lunar XPRIZE that challenges teams from around the world to land a rover on the Moon and send back live video to the \$10 million Qualcomm Tricorder, and the XPRIZE for handheld health diagnostics to the \$2 million Wendy Schmidt Ocean Health Prize - a competition to create breakthrough pH sensors that can help us begin the process of healing our oceans.

Upcoming prizes explore topic areas such as literacy, personal aerial transport, energy density, Alzheimer's, and organogenesis.

The XPRIZE Prize Model

XPRIZE believes we can make the impossible possible by creating an infrastructure where our world's innovators create breakthroughs that both catalyze industries and have a measureable benefit to humanity. We do this via large-scale incentive prize competitions.

Prizes are useful tools for solving problems for which the objective is clear, but the way to achieve it is not. By attracting diverse talent and a range of potential solutions, prizes draw out

many possible solutions – many of them unexpected – and steer the effort in directions that established experts might not go, but where the solution may nonetheless lie.

Prizes are powerful tools that have been around for centuries. In fact, 2014 marks the 300th anniversary of one of the most famous early prizes – the Longitude Prize – established by the British government in 1714 to reward the precise determination of a ship's longitude.

Prizes are powerful for many reasons, the most important of which include leveraging your investment, democratizing innovation, and reducing risk.

Throughout the course of a competition, teams spend their own money to compete for the prize. We find that teams spend research and development dollars that, aggregated across all teams, is four to ten times the value of the prize purse. So, you could give a grant or contract worth \$5 million and get \$5 million worth of research and development, or you can put out a prize with a purse of \$5 million and get upwards of \$20 to \$50 million worth. In a time of fiscal constraint, prizes are an extremely efficient tool to help spur innovation.

At XPRIZE we say, “Why find the needle in the haystack when that needle can find you?” Hosting a prize does just that. Prizes inspire teams from around the world to compete to achieve your goal – and often those that are inspired are not the current industry incumbents. Some solvers are from tangential fields and have a solution that could be tweaked to solve the challenge at hand, while others possess little to no experience at all. A prize does not care if someone has 20 years of experience or 20 days of experience – as long as they meet the goal of the competition. Using a traditional grant or contract, you would be very unlikely to find such innovators. Your focus would fall on the known players who comprise your target audience. Let me give you some examples. In the 1714 Longitude Prize, everyone assumed it would be a ship's captain or astronomer who would win. But it was a clockmaker. In the 1919 Orteig prize for the first person to fly between New York and Paris non-stop, everyone assumed it would be one of the aviation leaders. They all failed because they were too conservative in the design of their planes and how they flew. Instead, it was won by the relatively unknown, 25 year old mail pilot Charles Lindbergh. In our Progressive Insurance Automotive XPRIZE, we had a group of high school students surpass much of the competition. In our Wendy Schmidt Oil Cleanup XCHALLENGE, a tattoo artist made it into the finals. And although his team did not win, it still did better than the industry standard at that time. In fact, in that prize, four of the ten finalist teams were new to the industry. Most likely you would have never given a grant or contract to these innovators because (1) you would have seen it as too risky, (2) you never would have known they existed, and (3) they never knew they had an interest in solving the challenge prior to the prize. To get disruptive innovations, we need to democratize innovation – encouraging anyone from anywhere with any background to help solve our grandest challenges.

Third, prizes reduce risk. What separates prizes from traditional R&D and other funding mechanisms is that the burden of risk is wholly on the teams, since the prize is designed only to reward success. That is, you only pay when a team meets your goal. In a traditional grant or contract, you would award it to the known players because that is less risky for you. But the known players want to be successful, so they are not going to take those risks that are necessary to result in a truly transformational breakthrough. Failure is a necessity of invention, because innovation must build upon unsuccessful attempts. Those competing for the prize are willing to embrace this risk because they have little to lose. As we say at XPRIZE, “The day before anything is a breakthrough, it's a crazy idea!”

As you can see, prizes are extremely powerful and should be one of the tools in your innovation toolkit.

XPRIZE utilizes a proven system of prize design and prize operations to successfully reach near-term goals. XPRIZE undertakes detailed market, stakeholder, and risk analyses to inform both the design of the competition, as well as the associated marketing, media, and education plans. These analyses create the foundation for a sound competition structure and the detailed set of competition guidelines and judging criteria. XPRIZE prize design is focused on collaboration and the ability to bring in ideas from the outside. In doing so, much of the competition design is crowdsourced through expert interviews and comprehensive day-long Visioneering Workshops where XPRIZE concepts come to life.

Once competition guidelines are established, XPRIZE works to announce the competition at a high profile forum, and works to actively recruit a solver community. In addition, XPRIZE works to ensure that we support the solver community by hosting annual mandatory team summits; providing a robust online system for teams to gather and share information; ensuring that teams are meeting competition milestones; and establishing that all teams, regardless of their place in leaderboard standings, are considered heroes and innovators through XPRIZE's marketing and media efforts. Although prizes are about competition, we encourage the inherent collaboration of prize competitions to also shine.

That's what incentivized prize competitions are all about – democratizing innovation by drawing on the talent and ingenuity of people regardless of their experience.

Prizes are One Way to Spark the Innovation Cycle

We strongly believe that the private and public sectors must work together to utilize every tool available to facilitate meaningful innovation that drives economic growth. Prizes are not a replacement to traditional financing mechanisms, but are complements to them. They are one of many innovation tools that agencies and the Federal government should consider utilizing in tandem with other financial mechanisms such as grants, contracts, investments and incentives.

It is important to note that the resulting technology solutions are not replacements for behavioral change. Understanding how and where prizes work best will help ensure that they are used most efficiently and effectively. One of the hallmarks of an XPRIZE is its ability to create and/or catalyze industries. In this regard, the XPRIZE's impact does not begin at its launch, but with its award. As such, prizes are the beginning, not the end, of the innovation cycle, maximizing the impact on emerging industries, scaling new ideas, and ultimately contributing to the economy.

Prizes provide a mechanism to discover breakthroughs that generate, operate and become part of the industrial base. They can catalyze an industry in order to have a real set of benefits for humanity. When an industry undergoes a catalyzing event as the result of a breakthrough, everyone benefits – humanity, industry, and the public perception of what's possible.

Importance of Policy to Send a Signal

The federal government has rightly recognized the power of prize competitions to draw out the latent innovative vision that simply hasn't found the means or the outlet to reach its potential. Following passage of the 2010 America COMPETES Act, which granted agencies the authority

to operate prizes, and President Obama's "Strategy for American Innovation," which called on agencies to use Grand Challenges as an innovation tool, over 55 federal agencies have run more than 300 competitions to engage the public's most creative ideas. In 2013 alone, 25 agencies self-reported a total of 87 prizes – an 85 percent increase year-to-year. Research shows that the aggregate value of prizes more than tripled from 2000 – 2009, from \$125 to \$375 million – and that number continues to grow. These prizes have enabled government agencies to establish ambitious goals, pay only for success, and utilize novel approaches from outside partners to achieve their goals.

Now, Congress has an opportunity to once again use policy as a driver for innovation by including language supportive of prizes in legislation as it did in 2010 with the America COMPETES Act. We believe legislation that provides agencies with guidance to utilize high-impact prizes as an economically efficient way to incent innovation sends a strong signal to federal agencies, and also to the private sector and innovation community, that the federal government believes in the power of prizes as a source of innovation.

The Value of Public-Private Partnerships

At the crossroads of policy-driven innovation and 'garage ideas', I have witnessed remarkable breakthroughs brought about by critical partnerships between the public and private sector. For example, XPRIZE partnered with the Department of Energy to support a \$10 million global competition to inspire a new generation of viable, safe, affordable, and super fuel-efficient vehicles. We brought together government and the private sector, including our lead sponsor Progressive Automotive Insurance. Our top prize-winner, Oliver Kuttner, a commercial real estate developer who loved to tinker with cars since taking auto shop in high school, maxed out his wife's credit cards to invest in chasing his dream – which turned into a four-seat, 830-pound vehicle that ran on a one-cylinder, ethanol-fueled internal combustion engine that achieved 102.5 miles per gallon fuel efficiency. Today, Kuttner's company, Edison2, is continuing to develop extremely light, super fuel-efficient vehicles including an electric version. That is the kind of citizen innovation we take pride in fostering at XPRIZE.

Another ongoing example of government playing a supportive role even without supplying any financial support is a three and a half-year, \$10 million global competition to develop a consumer-friendly, handheld device capable of diagnosing and interpreting a set of 15 health conditions and capturing key vital signs. The Qualcomm Tricorder XPRIZE currently has 30 teams – from the United States, Canada, the United Kingdom, India, Greece, Taiwan and Slovenia – competing for the purse. The U.S. Food and Drug Administration is an integral partner in the effort, which XPRIZE is supporting with funding from our lead sponsor, the Qualcomm Foundation. In addition to assisting teams in preparing for future regulatory clearance post-competition, this prize competition is helping the Federal Drug Administration maximize its own readiness for new regulatory submissions in the direct-to-consumer diagnostics space.

Partnerships such as these have a history of maintaining a commitment to scientific excellence by guiding the conception, safety, and deployment for various technologies that have paved the way for the breakthroughs of today.

Policymakers can continue this great progress in prize-based, public-private partnerships by supporting prize language such as that included in the FIRST Act. Congress' passage of a bill that includes prize language would send a signal to agencies, the private sector and the innovation

community that the Federal government views the prize mechanism as an important solutions driver.

In short, public-private prize partnerships are a win-win: they drive American innovation by coupling unique government resources with the everyday ingenuity and entrepreneurship of citizen innovators to bring about dramatic breakthroughs for the benefit of humanity.

Conclusion

We strongly believe that the private and public sectors must work together to utilize every available tool to facilitate meaningful innovation that drives economic growth. Prizes are one such essential tool that agencies can, and should, employ.

Policy can send a strong signal to federal agencies, and also to the private sector and innovation community, that the federal government believes in the power of prizes as a source of innovation.

We look forward to continuing the dialogue with Congress about the power of prizes.

Chris Frangione, Vice President, Prize Development, XPRIZE

Christopher Frangione is the Vice President of Prize Development at XPRIZE, the world's leader in designing and managing large incentivized prize competitions that motivate and inspire brilliant innovators from all disciplines to leverage their intellectual and financial capital for the benefit of humanity. Frangione works at the intersection of audaciousness and achievability to ensure XPRIZE maximizes its positive impact. In this role, Frangione works with all departments of XPRIZE, prize sponsors, and other prize stakeholders to develop prize strategy.

Prior to joining XPRIZE, Frangione ran the market assessment practice at a boutique management consulting firm, where he consulted to CEOs of major engineering companies on all issues related to internal and external strategy. Frangione has leadership experience across all sectors of the energy industry, including serving as Manager of Operations and Business Development at Green Mountain Energy Company. In that role, he managed a regional market and defined new business opportunities, policies, and strategies for the retail renewable energy company. Frangione consistently seeks out entrepreneurial opportunities and has founded several organizations and helped others expand into new markets.

Frangione received his Bachelor of Arts in Environmental Policy from Colby College and Master of Business Administration and Master of Environmental Management from Duke University.

Chairman BUCSHON. Thank you very much.
I now recognize Mr. Wilson for five minutes for his—to present his testimony.

**TESTIMONY OF MR. DONNIE WILSON,
FOUNDER AND CEO,
ELASTEC AMERICAN MARINE**

Mr. WILSON. Thank you, Committee, for the opportunity to be here.

As you can imagine, winning the \$1 million XPRIZE makes us a leading fan of this competition.

My company has been manufacturing oil spill equipment for 20 years. We have been exporting globally to over 100 countries during that time.

On April 20th, 2010, approximately 42 miles offshore of the Southwest Pass, the Deepwater Horizon drilling rig exploded, causing the worst oil spill in U.S. history. The Deepwater Horizon incident prompted the XPRIZE Foundation and Wendy Schmidt was invited to be involved in the oil spill recovery XPRIZE challenge.

It was going to be a daunting task what they requested from industry to produce a skimmer that is capable of 2,500 gallons per minute recovery at 70 percent efficiency, three times the industry standard. So as we would all agree, XPRIZE always asks for audacious challenges. When we saw the challenge, we were not sure that we wanted to enter because it was much larger than any skimmer we had built. At that time it was 400 gallons a minute is our—was our current design.

What was interesting for us in this challenge was not only the \$1 million opportunity but to be able to prove that we could build the best skimmer in the world from the cornfields and oilfields of southern Illinois, 1,000 miles from the nearest coast. So I would agree that people that are not typically involved in such contests can be when you do it through competition.

Three hundred and forty-nine teams from around the world took part in the challenge. Ten finalists from five nations were involved. This was done at the Ohmsett facility in New Jersey, which is funded by the government and a fantastic place. Anyone ever gets a chance to go, they should. It is cutting-edge and the only place in the world that this could be done.

The Wendy Schmidt oil spill challenge brought together teams throughout the industry and were looking for new, fresh ideas.

It is hard to describe the benefits of such a prize because of the competition and what it can do to encourage people to think outside the box. There were contestants from all over the world, some doing things from their garage in Alaska to very focused competitors from different countries. To date, we have—we are starting to commercialize this product and we have sold nearly \$3 million worth of product in three different continents and we will be introducing versions of this X SKIMMER design in the coming months.

This competition gave Elastec/American Marine the faith and financial incentive to develop a new technology to keep our world clean, and I am pleased to comment about that today. Thank you.

[The prepared statement of Mr. Wilson follows:]



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Testimony from Elastec/American Marine CEO Donnie Wilson
 on "Prizes to Spur Innovation and Technology Breakthroughs"

April 9, 2014

The Committee on Science, Space and Technology, Subcommittee on Research and Technology of the
 U.S. House of Representatives

Elastec/American Marine has been manufacturing oil spill response equipment for over twenty years, including oil skimmers, fire boom, containment boom and a variety of pollution control-related accessories. The mechanical drum oil skimmer is the centerpiece of our product portfolio.

Oil spills occur all over the world, on land and in water, from pipelines to refineries, rail cars, oil rigs and industry. Our simple, lightweight drum skimmer systems are successful for a variety of reasons, but one primary feature is, they are oleophilic: they attract oil and repel water. Depending upon the type of oil spilled, our drum skimmers have an average oil recovery rate (ORR) ranging up to 400 gallons per minute or 90 cubic meters per hour.

We are always searching for innovations and new technologies. Several years ago we acquired a grooved disc oil skimming technology that had the potential for higher oil recovery volume, but it sat on the shelf for several years.

On April 20, 2010, approximately 42 nautical miles offshore from Southeast Pass, Louisiana in the Gulf of Mexico, the Deepwater Horizon drilling rig exploded. It was the worst offshore oil spill in U.S. history.

The Deepwater Horizon incident prompted the X PRIZE Foundation and Wendy Schmidt to invite not just the oil recovery industry, but anyone with imagination and drive, to take on the daunting challenge to produce a system capable of recovering oil from the surface of water at a minimum rate of 2,500 gallons of oil per minute, with an oil to water efficiency of at least 70%, while being towed at 1 to 4 knots--and to do this in both calm and wave conditions. And, the top prize was one million dollars!



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Elastec/American Marine entered the **Wendy Schmidt Oil Cleanup XCHALLENGE**, not for the money, but as an incentive to dust off and develop our grooved disc technology. We also entered the competition because of its global reach and for the media notoriety it could offer our company in a relatively unknown industry.

Along with 349 teams from around the world, Elastec/American Marine took up the challenge. Ten finalists from five nations tested their technologies in actual oil on water conditions at the National Oil Spill Response Research & Renewable Energy Test Facility (Ohmsett) test tank in New Jersey.

The secrecy surrounding the competitors' entries introduced additional incentive. When Elastec/American Marine first tested our grooved disc (the heart of our system), we knew we had something extraordinary. The minimum requirement in the competition was 2,500 gallons per minute, so that was not a "goal." We assumed that everyone else was aiming at 3,000, but what if those teams aspired to 3,500, or even 4,000 gallons per minute? We aimed higher.

Prior to the **Wendy Schmidt Oil Cleanup XCHALLENGE**, if you were to bring up those figures in relation to skimming possibilities, you would have been dismissed as a dreamer. But the incentive of winning \$1 million and the fame that comes with winning one of the X PRIZE Foundation's competitions now seemed within reach. **And Team Elastec won!**

Our skimmer system delivered an astonishing oil recovery rate of 4,670 gallons per minute at a nearly 90% efficiency ratio of oil to water. In just six months the X PRIZE Foundation had become the catalyst to advance the efficiencies of oil spill recovery more than in the previous twenty years.

The **Wendy Schmidt Oil Cleanup XCHALLENGE** brought together teams that have been in the industry for some time--and some with fresh new ideas. Elastec/American Marine has been in communication with some of those teams



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and has shared technologies and ideas to enhance each other's systems.

Competitive collaboration: another plus for incentive-based competitions.

And, we began to get noticed. Our skimmer system was honored by National Geographic and The Washington Post as among the best innovations in 2011. We won several international awards, including Popular Mechanics 2012 Breakthrough Technology Award, Offshore Arabia's prestigious Excellence in Environmental Applications Award and the Nafta Gaz Grand Prix Award at Oil & Gas Warsaw in Poland.

It is hard to describe all of the benefits Elastec/American Marine has experienced because of our winning the **Wendy Schmidt Oil Cleanup XCHALLENGE**, primarily because that book has not been completed. But new chapters are being written.

Had it not been for the **Wendy Schmidt Oil Cleanup XCHALLENGE**, we may not have developed the grooved disc skimming technology. And, had we developed the technology, it could have taken us a decade to do so.

For a company our size, we cannot afford to take too many uncalculated financial risks. However, winning the competition has helped us "prove" the grooved disc technology and in a relatively short time. We are currently in the process of developing a commercial line of X SKIMMER models that can operate in advancing or stationary modes.

To date, Elastec/American Marine has begun to sell several custom-built X SKIMMER models for use in the waters of three continents, and an X SKIMMER Offshore Launching System will be introduced at the International Oil Spill Conference in Savannah, Georgia next month.

This competition gave Elastec/American Marine the faith and the financial incentive to develop a new technology to keep our world clean.



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Donnie Wilson, Chairman and CEO Elastec/American Marine, Carmi, IL

4.9.14

The co-founder, chairman and CEO of Elastec/American Marine, Donnie Wilson, was born an entrepreneur. He likes to build things, whether it's gadgets or companies. Donnie started his first company at the age of 17 while in high school, fabricating equipment for gas and oil companies in the Illinois Basin in the United States. He went on to develop several successful enterprises in the oilfield service industry.

In 1989 Donnie's tank truck company was hired to clean up oil spilled in a swampy area near Carmi, Illinois. He purchased a European oil skimmer for the job and was frustrated because it recovered more water than oil. The annoying experience inspired Donnie and a colleague, Jeff Cantrell, to invent a better skimmer: an aluminum frame housing two oleophilic (oil-loving) plastic drums to recover oil. Not only did the drum skimmer work, it outperformed other skimmers on the market at that time. The invention captured the attention of oil spill responders at industry trade shows, and orders for the drum skimmers began to flow in at a rapid pace. In 1990 Wilson and Cantrell incorporated under the name Elastec.

As global awareness of the need for environmental protection increased, especially involving the cleanup of oil spills, Elastec recognized the need to distribute oil spill equipment internationally and opened an office in Russia in 1993. The company expanded into a full line of oil spill equipment and formed a partnership with American Marine, an oil and containment boom manufacturer with success in recovering oil in the 1989 Exxon Valdez spill. The Cocoa, Florida based company was founded in 1967 by Jim Pearce, a highly decorated WWII U.S. fighter Ace turned test pilot. Pearce was the first person to break the sound barrier flying an F-86. American Marine, in conjunction with Elastec, developed a water-cooled fire boom system for the controlled burning of oil spills. In 1997, Elastec purchased American Marine, forming Elastec/American Marine.

Elastec/American Marine has earned a reputation as an innovative manufacturer of quality pollution control equipment with a core competency in oil spill response systems. However, even though Elastec/American Marine's products were distributed in over 145 countries, the oil spill response industry was not well known.

Until April 20, 2010 when Transocean's Deepwater Horizon rig exploded in the Gulf of Mexico.

Elastec/American Marine's Hydro-Fire® Boom and American Fireboom systems were summoned to corral the oil for controlled burning. Not only did its fire boom systems outperform the competition's in the Gulf, Wilson was contracted to supervise the controlled burn operation for BP America.

During the Gulf spill there was an obvious void in mechanical equipment, such as oil skimmers, to recover high volumes of spilled oil. As a result, the X PRIZE Foundation, known for launching the private spaceflight industry through the \$10 million Ansari X PRIZE and other high-profile grand challenges, announced an incentive competition, the Wendy Schmidt Oil Cleanup X CHALLENGE. The goal of the competition was to inspire entrepreneurs, engineers and scientists worldwide to develop innovative, rapidly deployable and highly efficient methods of capturing crude oil from the ocean surface. Elastec/American Marine blew the competition out of the water with its patented grooved disc skimmer, winning the \$1 million first place prize out of 350 global entries. The company's skimmer (featuring 64 grooved discs) had an oil recovery rate (ORR) of 4,670 gallons of oil per minute with 89.5% oil recovery efficiency (ORE).



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Since then, the patented grooved disc oil skimming technology has received awards from around the world, including the *Popular Mechanics* 2012 Breakthrough Award, Offshore Arabia's prestigious Excellence in Environmental Applications Award and the Nafta Gaz Grand Prix Award at Oil & Gas Warsaw in Poland. Elastec/American Marine is also consistently listed among *Inc.* magazine's 500/5000's fastest-growing private companies in America.

Additionally, Elastec/American Marine's Hydro-Fire® Boom became "Officially Amazing" by receiving a GUINNESS WORLD RECORDS® title for the "Longest Continuous Controlled Burn of Oil Spill at Sea".

Oil spills are one of the most serious threats to the environment. Prevention is of the utmost importance, and preparedness is equally paramount. Improving and developing rapid response methods and equipment to aid oil spill response efforts led Elastec/American Marine in 2012 to acquire the marketing and manufacturing rights for *BoomVane*™. Developed and patented by ORC of Sweden, *BoomVane*™ simplifies the challenges of deploying containment boom in rivers and tidal waters without the need for boats or anchors. The technology combines the science of sailing with the art of flying a kite, in the water. The result is faster response time and less recovery expense.

In addition to manufacturing oil spill recovery equipment, Elastec/American Marine also manufactures pollution control systems such as portable incinerators for the disposal of medical waste and confiscated drugs, turbidity curtains for the control of silt and sediment in water, containment booms to control aquatic weeds, debris and invasive marine life, rapid response workboats, and a variety of other innovative environmental protection products.

The world headquarters of Elastec/American Marine is located in Carmi. The company's facilities encompass over 200,000 square feet in four manufacturing and warehousing facilities in southern Illinois and Cocoa, Florida. Satellite sales offices are located in Virginia, Washington State, India, Turkey and China. With over 140 employees, the company's products are distributed through a global network of dealers and an internal sales force.

Through the manufacture of innovative pollution control equipment, strategic acquisitions, leadership acumen and an instinct for business opportunities, Donnie Wilson, career entrepreneur, has guided Elastec/American Marine into position as a global leader in pollution response and control systems to keep our world clean.

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Chairman BUCSHON. Thank you very much.
I now recognize Mr. Singh for five minutes to present his testimony.

**TESTIMONY OF MR. NARINDER SINGH,
CO-FOUNDER AND CHIEF STRATEGY OFFICER,
APPIRIO AND PRESIDENT, [TOPCODER]**

Mr. SINGH. Chairman, Ranking Members of the Subcommittee, Members of the Subcommittee, I thank you for the invitation to speak before you.

My testimony here today will seek to expand even your view of prizes and show how we can act bigger by thinking smaller.

In 2006, myself and three others formed Appirio. Today, we have over 900 people with headquarters in San Francisco and Indianapolis. We have received numerous awards on "Best Places to Work," innovation awards. We were named the World Economic Forum Technology Pioneer in 2012.

[topcoder] enables that. It is a community of over 620,000 designers, developers, and data scientists, and it is based on prizes. We use this community to crowdsource hundreds of projects for commercial companies across the world, including private sector organizations like Comcast and Ferguson. What we do is we break down large projects into smaller pieces and we use prizes against each of those and hold many competitions. As a result, we run 5 to 10,000 competitive challenges each year. Our average prize amount for these challenges ranges from a few hundred to a few thousand dollars.

For example, recently with [topcoder], Appirio helped the research organization of a large pharmaceutical company improve the performance of software that runs Genome Wide Association Studies, or GWAS. GWAS is an approach to rapidly scanning markers across complete set of DNA. We reduced the time it took for them to run this from 10 hours to less than 30 seconds. What is remarkable is that the core of this advancement was driven by a series of about a dozen contests with about only \$50,000 in prizes. The firm plans to share this with the scientific community and it will completely change the way research is done with GWAS.

In government, we have partnered with NASA and Harvard Business School to create the NASA Tournament Lab at HBS. This lab focuses on creating insights on the optimal design of contest and also how the federal government can be more effective in using them. So essentially not only do we have to achieve results but we have got a bunch of researchers from Harvard peering over our shoulders while we do it.

So we have used this concept repeatedly of stringing together a series of smaller challenges to create some outstanding outcomes. So, for example, we used a set of challenges to reduce the time it took for NASA to optimize medical safety supplies on space excursions from 3 hours to 30 seconds. We have created a mobile application for International Space Station that will help astronauts manage their nutrition and health, and it was developed through a series of 18 challenges for less than \$60,000 in prize money, and it is in final testing for spaceflight now.

We also just launched the NASA Asteroid Grand Challenge on [topcoder] with Harvard and Planetary Resources to improve the detection algorithms of detecting asteroids. It consists of a series of 10 related challenges and we hope for a similar leap forward in accuracy of algorithms, and the total prize will be under \$100,000.

We have also worked with other government agencies through NASA's Center of Excellence for Collaborative Innovation. One of the projects was for the Center of Medicare and Medicaid Services seeking to modernize the CMS infrastructure for the State of Minnesota so that healthcare providers could register more easily. This project spanned 11 months, had more than 140 challenges on [topcoder], and the total cost including labor was about \$1.5 million. Research from Harvard Business School and the NASA Tournament Lab shows that done through traditional approaches, it would have been \$7.5 million or nearly five times as much.

I believe in large prizes and their capability to create entire markets by—proven by my colleagues from XPRIZE. But breaking problems down allows for giant leaps forward to occur inside of existing markets. And by breaking problems down, we can increase the power of prizes to be applied to a much wider set of activities.

To do so, we do need more scalable rules for government. For example, it appears in the current language of FIRST that it would require private-sector judges to disclose their financials. For challenges to a few hundred to a few thousand dollars, this is an onerous burden, especially given that, for example, all of our reviews are publicly available and often evaluated by a computer program.

More than anything I have said here today, the one thing I feel confident about is that the rate of change of advancement of technology will not slow down. 3-D printing, robotics, biotech, artificial intelligence, and even wearables, many other domains are just getting started. More than ever, we will need the ability to quickly and efficiently tap into the right skills instantaneously.

So the nature of our economic system is built upon a free market and for a good reason. In most cases it is the most efficient way. Crowdsourcing taps into the power of the market, but also democratizes participation beyond a few select firms that can compete in large institutions and allows anybody to jump in and to try their hands. Crowdsourcing itself is an innovation, but in this context, even more importantly it allows you to keep pace with innovation.

I want to thank the Committee for the opportunity to share my perspectives and would be happy to take any questions.

[The prepared statement of Mr. Singh follows:]

Written Testimony of Narinder Singh

President [topcoder], Co-founder and Chief Strategy Officer, Appirio

Before the Subcommittee on Research and Technology
Hearing - Prizes to Spur Innovation and Technology Breakthroughs
US House of Representatives
April 9, 2014

Chairman, Ranking Member, and Members of the Subcommittee, my name is Narinder Singh, and I am the co-founder and Chief Strategy Officer of Appirio, and the President of it's [topcoder] division. I appreciate the invitation to speak before this esteemed body to address these exciting topics. We believe crowdsourcing--and specifically community-based development incented by prizes--can lead to dramatic innovation, substantially increase efficiency (reduce cost) and produce much higher quality levels of technology development for both the private and public sectors.

We started Appirio in 2006. Today, it employs over 900 people with headquarters in San Francisco and Indianapolis. We have routinely been named on "Best Places to Work" lists in the San Francisco area and in Indiana, have received numerous innovation awards, and in 2012 were named a World Economic Forum Technology Pioneer.

Our [topcoder] community consists of over 600,000 designers, developers, and data scientists. Through [topcoder] we have taken hundreds of projects for our clients and crowdsourced them through the community. This involves breaking down complex projects into smaller components and using prizes - challenge based competitions - to complete them. As a result we run five to ten thousand competitive challenges (prizes) each year through the [topcoder] community. Our average amount for each of these prizes ranges from a few hundred to few thousand dollars.

This approach has helped leading private sector and government agencies to achieve amazing results in technology that impact science and technology. In 2013 Harvard Medical School and the February edition of Nature Biotechnology ("Prize-based contests can provide solutions to computational biology problems") described how the [topcoder] community helped Harvard Medical School improve NIH BLAST, an algorithm that aids in genetic research, by 1000x in just two weeks. The challenge received 122 different submissions and awarded a total of \$6,000 in prizes.

More recently with [topcoder], Appirio helped the research organization of a large pharmaceutical firm improve the performance of software that runs Genome Wide Association Studies (GWAS) - an approach to rapidly scan markers across complete sets of DNA. We reduced the run-time from approximately ten hours to less than thirty seconds. This advancement is soon to be shared with the scientific community and will change the way research is conducted. Remarkably, the core of this advancement was driven by a series of less than a dozen contests with approximately \$50,000 in prizes.

In government, NASA has partnered with Harvard Business School and [topcoder] to create the Harvard NASA Tournament Lab (NTL). This lab focuses on creating cutting edge insights on the optimal design of contests and ways in which the federal government can be more effective in the use of prize-based competitions. Together we have repeatedly used the concept of connecting a string of smaller prizes together to achieve large scale success.

For example:

- NASA used a set of challenges to reduce the time for an algorithm to optimize medical supplies on space excursions from three hours to less than thirty seconds (completed).
- The ISS FIT application, a mobile application to help astronauts track nutrition and health on the International Space Station, was developed through 18 challenges on [topcoder] for less than \$60,000 in prizes (in final testing).
- Currently, the NASA Asteroid Grand Challenge series is running on [topcoder] with a partnership between NASA and Planetary Resources Inc. (PRI) to improve the ability to detect asteroids. It consists of a series of ten interconnected challenges and we hope for a similar leap forward in capability (as we have seen in other challenges) for well under one hundred thousand dollars (recently initiated).

In addition, under NASA's leadership with their Center of Excellence for Collaborative Innovation (CoECI), the NTL and [topcoder] have worked with several other government agencies including the Center of Medicare and Medicaid Services. A project to modernize CMS infrastructure so that health care providers can easily register (while at the same time states can be proactive in limiting access to bad actors) was developed for the state of Minnesota through a series of challenges. Over eleven months over 140 challenges were executed to complete the project. The total cost of labor and challenge funds was approximately \$1.5 million. Forthcoming research from the NTL indicates that done through traditional models, the initiative would have cost the government nearly \$7.5 million.

Predominantly, our business is with private sector companies. Organizations like Comcast and Ferguson have successfully used [topcoder] by breaking large software development projects into smaller competitive prizes. Breaking down large problems into smaller ones offers several key benefits for both projects and prizes.

- **It creates more competitive markets.** By breaking down prizes you increase the number of companies or individuals who can compete in the market. For example there are only a few firms in the world that can compete for a \$700M project, but there are tens of thousands of firms that can compete for a \$7M one - and hundreds of millions of individuals who could potentially compete in a \$7000 challenge.
- **It de-risks work through specialization.** Crowdsourcing works in part because it allows organizations to tap into a much broader set of talent than otherwise possible. It also allows organizations to use markets to match the best supply (talent) to the demand of the individual task. With market volume, community members start to specialize in the areas they are best qualified to deliver outstanding results in. Quite simply, people

can work at what they are best at. When every task in a larger initiative is done in this manner, dramatic results become the norm.

- **It increases participation and education.** While somewhat counter-intuitive, a smaller number of connected prizes can actually increase participation. Participants in prize challenges certainly compete for the chance to be rewarded. But with micro competitions, learning is often also a significant objective. The community of participants shares knowledge extensively and broadly after each competition - creating amongst the best on the job training available.
- **It creates objective measures of skill.** Each competition contributes to a skill rating for the participant. With a volume of competitions you can objectively see the ratings of an individual and the community improve. At [topcoder] we will often run a series of challenges to create an output (like the ones described above) but also to educate a community on a new technology or product. As a result, we know our community is better skilled to take on the next set of challenges in that domain.

We believe in large prizes and their capability to create entire markets as proven again and again by my esteemed colleagues from xPrize. But we also believe micro challenges allow the concept of prizes to be applied to a much larger category of work. By breaking innovative or even common problems down, exponential innovation can occur inside of existing markets.

The rationale for government involvement in prize competitions

We all recognize the importance of scientific and technological advancements in spurring growth. Traditionally, the government's role in this has been to subsidize research and development of novel ideas and technologies, in the hope that these will produce fruitful advancements. This remains a critical function.

Note that prize-based competitions constitute a novel complement to this strategy. They differ from this traditional approach in two fundamental ways. First, prizes are paid not based on potential, but rather upon the delivery of results. Practical application and performance is therefore tied to disbursement of funds. Second, they don't require taking a guess on who will produce the sought-after solution. They leverage competitive forces to reward the individual who delivers best solution. Thus, as demonstrated by the examples above, prizes use government funds judiciously--ensuring practical application and rewarding performance.

Commentary on the FIRST Act as related to prize competitions

We applaud the desire to include prizes and competitions in the FIRST act, but also have concerns around unintended consequences for micro challenges and connected initiatives.

The FIRST Act currently states that even for private sector judges, "All judges shall be required to disclose all personal financial interests." It's not immediately clear if this refers to all interests related to the prize they are administering, or simply all their financial interests. In the case of

the latter, for challenges of a few hundred to a few thousand dollars, it's an onerous burden and counterproductive to the Act's intent.

For example, often at [topcoder] we use certified, non competing, community members to judge competitions. In these cases their scorecards and evaluations are open and subject to public peer review. In other cases, the formal judge may only enforce high level guidelines and settle disputes because the competition itself is judged and evaluated by a computer program that scores each entry. The intent in the FIRST Act in these regards is appropriate - to create transparency and fairness in oversight. But the current language could instead hinder adoption of prizes inside the government.

Broader view on making government more tech savvy

More broadly, applying this market-based approach of a large volume of micro-prizes in government requires a reduction in bureaucracy and friction of engagement. More directly, it would be unlikely [topcoder] or similar communities would choose to greatly expand presence in government sectors if requirements of audit and financial reporting remain hardwired for legacy approaches to government contracting. It's just too hard to do business with the government. Even in submitting this written testimony it was required that forty five hard copies be hand delivered in advance - an approach to information sharing that exists only with the government.

All of this in combination can leave firms like mine with few practical options beyond either working with niche groups in the government who are willing to invest significant resources in helping navigate its complicated waters (like NASA); or through third party firms that specialize predominantly in government work. Ultimately, rather than government guidelines that attempt to enforce fairness in every scenario, a more competitive market is what will most help government operate more efficiently and be exposed to the tools and techniques that advance innovation.

Creating conditions for success in competitions

Research by Professor Karim Lakhani at Harvard and his colleagues¹ has shown that contests bring into play three distinct mechanisms:

1. They enable many independent "shots on goal" so that the likelihood of finding the best solution increases substantially;

¹ Boudreau, Kevin J., Nicola Lacetera, and Karim R. Lakhani. "Incentives and Problem Uncertainty in Innovation Contests: An Empirical Analysis." *Management Science* 57, no. 5 (May 2011): 843–863.
 Jeppesen, Lars Bo, and Karim R. Lakhani. "Marginality and Problem-Solving Effectiveness in Broadcast Search." *Organization Science* 21 (September–October 2010): 1016–1033.
 King, Andrew, and Karim R. Lakhani. "Using Open Innovation to Identify the Best Ideas." *MIT Sloan Management Review* 55, no. 1 (Fall 2013): 41–48.
 Boudreau, Kevin J., and Karim R. Lakhani. "Using the Crowd as an Innovation Partner." *Harvard Business Review* 91, no. 4 (April 2013): 61–69.
 Guinan, Eva C., Kevin J. Boudreau, and Karim R. Lakhani. "Experiments in Open Innovation at Harvard Medical School." *Art. 3. MIT Sloan Management Review* 54, no. 3 (Spring, 2013): 45–52

2. Open entry in contests means that people outside of the traditional siloed knowledge domains of the problem can now have the chance to propose unconventional and radical solutions;
3. People are self-motivated - a variety of reasons drive participation in contests including winning the cash prize, demonstrating expertise to potential employers or their peers or just plain having fun.

All of these mechanisms have been shown to be important to successful contest execution. For government it is important to pair this with a clear sense of the objective of the prize. In some cases large cash prizes are used to draw attention to a problem area and spur private investment to advance or even create an industry. In other cases, many of which have been cited here, prizes provide an opportunity to exponentially advance an area, remove a constraint or just build more effectively.

In all cases it is important to **create a clear sets of criteria for participants**. What does it take to 'win', how will entries be scored, what timelines will be adhered to, etc. Idea generation will have very different dynamics than executing on very specific tasks. Large prizes will have more scrutiny than smaller ones, but the need for clarity and transparency transcend all categories. You will ultimately get what your rules incent.

Conclusion: the pace of change will not slow down

The rate of technology advancement will not slow down. Over the past decade we've seen our lives transformed into a world of constant connectivity. In addition to this new global platform of information exchange, we are seeing dramatic advancements in 3D printing, robotics, bio technologies, artificial intelligence, wearable computing and many other domains. More than ever, we will need the ability to quickly and efficiently tap into the right skills instantaneously. Even in traditional domains, like creating web based solutions for government, the scale of adoption and need to evolve quickly require a new pace and capability.

The nature of our economic system is built upon the free market and for good reason - in most cases it's the most efficient system. Crowdsourcing taps into the power of markets but also democratizes participation beyond select firms to anyone who has the capabilities to contribute.

I thank the Committee for the opportunity to share my perspectives and would be happy to respond to any questions you may have on these topics.

Summary of Testimony

- Prizes based competitions can create exponential results and breakthrough in innovation. These can consist of large grand prizes or by breaking down larger problems into much smaller pieces.
- Smaller micro level competitions expand the number and types of problems that can be tackled by prizes.
- Breaking down large problems into smaller ones offers several key benefits for both projects and prizes.
 - Creates a more competitive market for work
 - De risks work through specialization
 - Increases participation and education
 - It creates objective measures of skill
- Often new practices and innovation have long lead times and uncertain results. Crowdsourcing and prize based competitions, however, can be initiated to address immediate constraints on scientific research problems, technology innovation and large development initiatives.
- The intent of transparency and objectivity is critical in competitions and a core pillar of the FIRST act with regards to prize competitions. However, if the language in the FIRST act requires that private sector judges disclose all their financial interests, it will hamper desire / adoption of private sector companies to work with government in this manner.
- More broadly, government should seek to provide mechanisms that allow for emerging private sector companies to engage with the government in more streamlined manners - without that government will continue to restrict the competition in their own market for services and innovation.
- Successful prizes operate with clarity and transparency of both their purpose and how they engage with the participants who compete for them. They succeed because of the number and variety of participants they can tap into and the individual motivations of the competitors to participate. Rules and guidelines for prizes should align with these incentives.
- To keep pace with technological innovation, government needs to encourage new approaches that can more rapidly adjust to today's needs. Markets tapped into via crowdsourcing can increase this dynamism and broaden participation with government.

Narinder Singh

As the President of the [topcoder]™ community and Chief Strategy Officer at Appirio, Narinder is responsible for overseeing the company's strategy, technology and crowdsourcing initiatives. A co-founder of Appirio, Narinder brings nearly 20 years of software and business experience and plays a key role in keeping Appirio at the forefront of cloud, social and mobile technology.

Prior to Appirio, Narinder worked at SAP in the Office of the CEO as a part of the Corporate Strategy Group. Working with the management board and other executives, Narinder led initiatives on sales, maintenance and competitive strategies, as well as potential business and technology disruptions.

Prior to SAP, Narinder managed R&D, sales and marketing activity as vice president and general manager of webMethods (WEBM) workflow business unit. He also previously led R&D for the company's BPM, workflow, B2B and industry products. Narinder began his career with Accenture at its Center for Strategic Technology.

He holds a Bachelor of Science from Northwestern University and an MBA from the Wharton School. Narinder also has worked with several non-profits on their development and supports a number of causes including the Miracle Foundation and Architecture for Humanity. He has won numerous awards for business and technology leadership including the San Francisco Business Times '40 Under 40' in 2013. He is the executive sponsor of Appirio's Silver Lining program and serves on the board of the Sikh Coalition.

Chairman BUCSHON. Thank you very much.
I now recognize Dr. Moe for her testimony.

**TESTIMONY OF DR. SHARON MOE, PRESIDENT,
AMERICAN SOCIETY OF NEPHROLOGY**

Dr. MOE. Chairman Bucshon, Congressman Lipinski, and Members of the Committee, my name is Dr. Sharon Moe and I am President of the American Society of Nephrologist, better known as ASN. I am a kidney doctor in Indianapolis, Indiana, and Professor of Medicine, Director of the Division of Nephrology at the Indiana University School of Medicine. I thank the Committee for calling this hearing to discuss the role of prize competitions in promoting innovation. We would like to put forth the innovation in dialysis as a worthy topic for a prize.

With nearly 15,000 physicians, scientists, nurses, and other healthcare professionals, ASN leads the fight against kidney disease. Kidney disease is the 8th leading cause of death the United States. It is a silent killer that destroys lives and places a staggering burden on our society. Of the more than 20 million Americans with kidney disease, nearly 450,000 have progressed to complete kidney failure and rely on Medicare End-Stage Renal Disease Program for lifesaving dialysis. The ESRD program costs \$35 billion annually and covers all Americans, regardless of age or disability. Despite this spending, kidney care has not advanced in the 25 years that I have been practicing nephrology. ASN believes that a prize competition is an optimal way to promote innovation, reduce costs, and improve patient outcomes and quality of life.

Dialysis keeps patients alive but it doesn't come close to replacing normal kidney function. It does not return patients to full health or allow them to pursue full-time employment. Innovation has been stymied by a lack of competition among payers and a payment system that doesn't support novel therapies. If Congress uses a prize competition to signal that it wants alternatives to currently available dialysis care, I believe the private sector will produce life-changing, cost-saving alternatives to dialysis.

I have a 48-year-old patient who epitomizes the need for innovation, 48. He survived cancer but damage from the radiation treatment caused kidney failure. He is on dialysis, still awaiting a kidney transplant despite three years on the list. He tried dialyzing at night so he could continue to work but was too sick to function. He had to quit work and go on disability. He recently told me, Doc, I just can't take it anymore. I hate the needles. I hate feeling bad all the time. I can't work. It seems like a transplant will never happen. I would like to stop dialysis. Will you be my doctor while I die? A 48-year-old went from working full-time to contemplating death over dialysis in just one year. That is because the few options available to him have not significantly advanced in the last 25 years.

This reality is in stark contrast to dramatic therapeutic advances for other chronic diseases. We have developed insulin pumps that deliver accurate insulin doses, implantable defibrillators that shock the heart back to function, and robotic surgery to minimize hospital stays and pain after gallbladder and prostate surgery, just to name a few.

In contrast, dialysis machines have become smaller, computerized, and more portable so that some patients can dialyze at home. However, patients still endure getting stuck with two needles three times a week at minimum and their blood being filtered through for an average of 12 hours a week.

We need breakthroughs, not incremental changes to old technology. A prize competition that helps harness the power of the private sector can spur the scientific and technological breakthroughs to deliver improved technology for kidney replacement therapy. The FIRST Act would help pave the way for such an incentive by providing the guidance that federal agencies need to make prize competitions a reality. We need to transform dialysis or prevent the need for it altogether.

Prize competitions are a powerful lever, as you have heard, that would draw a diverse group of inventors, scientists, and investors to innovate and develop better alternatives. Such innovation would improve the lives of thousands of Americans on dialysis covered by the Medicare ESRD program and offer hope to the 20 million Americans facing the possibility of dialysis in the future.

I appreciate the opportunity to testify and would welcome any questions. Thank you.

[The prepared statement of Dr. Moe follows:]

**Written Testimony – House Space, Science and Technology Committee
Sharon M. Moe MD, FASN**

Chairman Smith, Ranking Member Johnson, and Members of the Committee, my name is Dr. Sharon Moe, and I am the President of the American Society of Nephrology, better known as ASN. I'm a nephrologist, or kidney doctor, in Indianapolis, Indiana and Professor of Medicine, and the Director of the Division of Nephrology in the Department of Medicine at the Indiana University School of Medicine. I thank the committee for calling this hearing to discuss the role of prize competitions in promoting innovation, and I appreciate the opportunity to testify before you today.

With nearly 15,000 physicians, scientists, nurses, and other healthcare professionals in more than 110 countries, ASN leads the fight against kidney disease. Kidney disease is the eighth leading cause of death in the United States. It is a silent killer that destroys lives and families, placing a staggering burden on public health, resources, and society. Most of the more than 20 million Americans with kidney disease remain unaware of its presence; these patients are at high risk to progress to kidney failure that requires dialysis or transplantation.

Today, the nearly 450,000 Americans whose kidney disease has progressed to complete kidney failure rely on the Medicare End-Stage Renal Disease (ESRD) Program for lifesaving dialysis. The ESRD Program is the only federal health entitlement program that provides coverage regardless of age or disability. Caring for people with kidney failure costs Medicare nearly \$35 billion annually. Patients with ESRD account for less than 1% of the Medicare population but their care constitutes 7% of the program's budget. Again, all Americans, regardless of age, income, or eligibility for any other federal program, qualify for coverage under the Medicare ESRD Program.

This automatic eligibility for Medicare distinguishes kidney disease care from any other aspect of health-related spending in the federal government. When it comes to the ESRD program, you are already "all in" and essentially shouldering nearly 100% of the cost of dialysis for every American with kidney failure. We must work together to innovate, to continually improve care, to help the millions of kidney patients become more productive citizens, and to contain the costs of the program. We must incentivize the development of therapies that give the ESRD program greater value for the taxpayers' contribution in terms of lower expenditures on care and better outcomes for patients.

When the ESRD Program began in 1972, innovative changes in care improved our patients' lives. But over the last 25 years, there have been too few advances in improving the clinical outcomes of Americans with kidney failure and increasing the cost-effectiveness of kidney care. Dialysis and kidney care have not advanced at the same pace as treatments for other life-threatening chronic illness, despite the significant annual cost of providing this lifesaving care. Most people with kidney failure rely on thrice-weekly, in-center dialysis—a time-consuming process that often fails to restore patients to full-time careers.

Dialysis, while keeping patients alive, does not come close to replacing normal kidney function. Patients on dialysis do not regain their healthier lives. The federal government pays \$35 billion a year on dialysis care. Don't patients and taxpayers deserve progress in treatment that parallel advances in other diseases? That's why a prize competition in

kidney innovation is so critical to raise the stakes for innovative technologies to be developed, and that's why I'm testifying today.

A prize competition is what is needed to drive the health sector to innovate and reduce dependency on the current form of dialysis provided by the ESRD program. If Congress signals to the private sector that you want alternatives to the forms of dialysis currently covered by the ESRD program, then I believe companies, investors, and inventors will produce life-changing and cost-saving technologies. The knowledge is available to invent alternatives such as a bioengineered kidney or other technologies that don't simply make different machines, but instead revolutionize kidney replacement therapy altogether.

My patients are constantly asking for an alternative to dialysis as the thought of being hooked up to a machine three times a week is terrifying. I have a 48-year-old patient who epitomizes the need for innovation in kidney care. My patient has kidney damage that was the result of radiation therapy for his now-cured cancer. His kidney disease has slowly progressed and, as soon as he was eligible, we placed him on the transplant wait list along with 99,970 other Americans. My patient did everything he could to slow the progression of the disease: he took his medications, kept all his appointments, and even participated in every possible clinical research study I suggested. But, his kidney disease still progressed to kidney failure.

My 48-year-old patient is deathly afraid of needles, and when he finally started dialysis, he had to take medications to tolerate getting stuck with large needles three times a week. He tried dialyzing at night so he could keep working full time, but he felt too sick to function at work and had to go on disability. Twice he was called for a transplant, and both times something was wrong with the kidney and he did not get a transplant. He is now dialyzing in a unit closer to his home under the care of another physician.

A few weeks ago, he sent me an email that said, "I can't take it anymore. I feel bad all the time. I can't work. I thought dialysis was a bridge to transplant, and it seems like the transplant will never happen. I would like to stop dialysis. Will you be my doctor while I die?"

He went from working full time to contemplating death as a better option than dialysis. Surely we can do better. I am frustrated that I have no other options for this patient and that the options I do have for him have not significantly advanced since I became a nephrologist.

Since I started caring for patients with kidney disease 25 years ago, the therapeutic developments have been minimal, especially compared to the dramatic therapeutic advances for other chronic diseases. For example, 25 years ago, patients with abnormal heartbeats were at risk of dying suddenly. Now we have technologies to test specific parts of the heart to understand where the abnormal beats come from. We also have the technologies to fix these abnormalities and small devices placed on the heart called implantable defibrillators that sense abnormal heartbeats and deliver a lifesaving shock .

25 years ago, patients with prostate cancer had major abdominal surgeries requiring long hospital-based recovery stays. They were often left with impaired sexual and

urinary function. Now, surgeons perform robotic surgery, leaving just with three small holes in the belly and a patient who can return home complication-free in two days.

These advances in biotechnology—insulin pumps, arrhythmia detectors, and robotic instruments for surgery—have all improved quality of life for patients with diabetes, heart disease, and cancer.

In the last 25 years, we have made the dialysis machines smaller and computerized, and we have made the tubes and dialyzers better. The smaller machines have made them more portable so that dialysis can be done at home, but these changes are incremental. Patients still get stuck with two needles, and have their blood run through a filter. This basic dialysis technique has not changed in 25 years. Our kidneys function 24/7; most patients get dialysis 12 hours a week in outpatient centers.

What has changed is that more and more patients need dialysis, increasing the costs of the ESRD program to the federal government. It is time for you to make the statement that we need innovation in kidney care. That is what a prize competition could do for patients, taxpayers, and health professionals, including the 15,000 ASN members.

I feel strongly that current scientific knowledge in the understanding of the kidney is at a level that makes such life-altering innovation a real possibility. I firmly believe American ingenuity is ready and willing to take this basic knowledge and turn it into a transformative, cost-saving technology that offers real hope for a better life to patients suffering through the current consequences of dialysis. Together, we can offer hope to the 20 million Americans with kidney disease who fear dialysis is in their future.

A prize competition that helps harness the power of the private sector can spur the scientific and technological breakthroughs to deliver improved technology for kidney replacement therapy. The legislative language in the FIRST Act (HR 4168) would pave the way for such an incentive, as well as other important scientific prize competitions, by providing the guidance that federal agencies need to make the competitions a reality.

Currently, the encouragement to innovate in dialysis therapies is limited, because we think of dialysis as saving lives. While obviously a laudable accomplishment, we need to recognize that the quality of these lives is poor and thus alternative therapies are needed. In part, innovation is limited due to the lack of competition among payers in the dialysis market. The recent implementation of a fully bundled payment for dialysis care has also exacerbated the absence of market forces driving innovation.

My patients don't feel good on dialysis and want an alternative. But, it is challenging for such patients to advocate for innovation and for the development of better therapies. They cannot miss the lifesaving—but time-consuming and exhausting—dialysis treatments. They are often sicker than patients with other chronic diseases, making it hard to advocate for more research and innovation. This challenge is another reality that highlights how a prize competition could uniquely fill a gap to spur much-needed innovation in kidney care.

Historically, dialysis was thought of as a bridge to kidney transplantation. However, the increase in the number of patients with kidney disease without an increase in the number of available organs has left patients waiting for a transplant for years, often feeling miserable, like my 48-year-old patient. In fact, most patients die on dialysis

waiting for an available kidney. We need to transform dialysis, or prevent the need for dialysis, so that patients can return to healthier and more productive lives. This reality is a prime challenge for a prize competition to help tackle: by drawing a broader, more diverse group of inventors, scientists, and investors beyond the traditional kidney community to innovate and help find alternatives to dialysis, we can work together to dramatically increase the likelihood of real innovation in kidney replacement therapy. Such advancements have been a long time coming.

Beyond its robust support for the prize competition provisions in the FIRST Act, ASN is working on a number of fronts to promote innovation in the kidney space, to better prevent kidney failure that requires dialysis in the first place, and to make dialysis a more effective, efficient process for those who do progress to kidney failure. For example, ASN partnered with the Food and Drug Association in September 2012 to establish the Kidney Health Initiative.

The Kidney Health Initiative has 65 members, from ASN and FDA to other health professional organizations and patient groups to biotechnology, pharmaceutical, and medical device companies to dialysis providers and startups. The goal of the Kidney Health Initiative is to provide a platform to increase innovation in drugs, devices, biologics, and food safety to improve the lives of millions of people with kidney disease. It is clear from the number of partners in this initiative that the interest in improving kidney care is broad.

ASN believes that a prize competition is another powerful lever that could significantly spur development of a novel kidney replacement therapy that is more efficient and cost-effective than current therapies and makes patients feel better. Such a competition could help mobilize the private sector to facilitate meaningful innovation to address one of the costliest challenges our government faces today—and to improve the lives of hundreds of thousands of Americans saved by the Medicare ESRD Program as well as the millions of Americans at-risk for kidney failure.

I appreciate the opportunity to testify and welcome any questions you might have.

Sharon M. Moe, MD
President, American Society of Nephrology

Stuart A. Kleit Professor of Medicine
Indiana University School of Medicine, Indianapolis
Division Director, Nephrology

Dr. Moe received her medical degree from the University of Illinois - College of Medicine at Chicago in 1989. She completed her internship and residency in the Department of Internal Medicine at Loyola University Medical Center in Maywood, Illinois. Her research and clinical fellowships were completed in the Section of Nephrology of the Department of Medicine at the University of Chicago in Illinois. She has been a faculty member at Indiana University since 1992 and is currently Division Director for Nephrology in the Department of Medicine at Indiana University School of Medicine and Section Chief for Nephrology at the Roudebush VA Medical Center.

Dr. Moe is the principal investigator for several ongoing clinical and basic research studies in the field of vascular calcification and bone and mineral metabolism in kidney disease. Her research is funded by the Veterans Affairs Department, the National Institutes of Health, and Pharmaceutical Companies. She has authored over 140 scientific manuscripts, teaching manuscripts and textbook chapters about CKD-Mineral Bone Disorders, Renal Osteodystrophy and Vascular Calcification.

Dr. Moe served on the National Kidney Foundation's Bone and Mineral metabolism K/DOQI clinical practice guidelines in 2003 and was co-chair of the international KDIGO Mineral and Bone guidelines released in 2009. She was a Councilor to the International Society of Nephrology from 2005-2007. She is currently President Elect, and one of six Councilors for the American Society of Nephrology (ASN), and will be President of the ASN beginning in November 2014. Key Honors include election to the American Society for Clinical Research in 2005; the National Kidney Foundation in Gareb Eknayan Award for exceptional contributions to key initiatives of the such as the Kidney Disease Outcomes Quality Initiative (KDOQI) in 2009; and the National Kidney Foundation of Indiana Legion of Honor Award in 2011.

Chairman BUCSHON. Thank you very much.

At this time I would like to recognize the newest Member of the Subcommittee and the full Committee of Science, Space, and Technology, Mr. Johnson from Ohio. Welcome to the Committee and to the Subcommittee.

Mr. JOHNSON. Well, Mr. Chairman, it is good to join. Science and technology is a passion of mine as a patent holder myself and an innovator, which is a long way from the mule farm that I grew up on, by the way, so I am excited about being here and I look forward to working with all of our colleagues to move things along.

Chairman BUCSHON. Thank you.

I would like to thank the witnesses for your testimony. It is fascinating testimony from all of you.

Reminding Members that the Committee rules limit questioning to five minutes, and the Chair at this point will open the round of questions. I recognize myself for five minutes.

Dr. Moe, more specifically, how does the legislative language in the FIRST Act advance and help scientific prize competitions do you think?

Dr. MOE. I think there is a lot of interest in prize competitions, but as we have talked to committees and organizations, there is some confusion as to what their role is and how they can actually go about competing or being part of a prize competition. And so I think that will actually enable more associations such as our ASN to go together with Congressional offices, with Committees, with other Committees on the Hill to actually improve the ability to conduct a prize.

I think a prize, particularly in our field, is important. A lot of these have not been in the healthcare field and I think that is really an important problem, particularly when we look at dialysis patients and the cost that is to society and the fact that we are not really bringing these people—we are not really advancing the technology that we can do in other areas of medicine and we have done in other areas of medicine.

Chairman BUCSHON. Mr. Frangione, do you want to make some comments about that?

Mr. FRANGIONE. Sure. I think the America COMPETES did a great job giving broad authority to agencies to do prizes, but every agency is interpreting it a little bit differently.

Dr. MOE. Yes.

Mr. FRANGIONE. And any clarification that can encourage agencies to use it in a more systematic way or a more universal way would be extremely helpful.

And there are a couple of things that we think are important in a prize. If you throw a prize, just like if you throw a party, nobody is going to come unless you invite them, right? And so we actually actively go out and recruit teams. We go to conferences and we talk and we market and that really helps draw teams in. And I think that is an important thing for the agencies to understand.

The other really important thing is supporting the teams during the competition. We don't give them money to compete but we give them the support. We connect them with potential funders. We teach them how to do business plans because, as everybody knows, the best innovators aren't necessarily the best business people and

we want every single team out there to be successful after the prize competition is over in that market.

So the key is really ensuring that you support the competition as it is occurring, the teams, the marketing, the media, the education. Otherwise, you are going to have one or two people show up to compete and you are not going to get the results that a prize can bring you.

Chairman BUCSHON. So what principles do you use to select the prize targets and find appropriate sponsors? And can you go over what some of the best practices to develop these public-private prize—

Mr. FRANGIONE. Sure.

Chairman BUCSHON. —partnerships might be?

Mr. FRANGIONE. Sure. So we—when we design a prize, we crowdsource our prizes, not from the general public but we end up interviewing anywhere from 50 to 150 experts. We spend six to nine months just designing a prize because once you launch it, you don't really have the opportunity to change the rules, right, because the teams are spending their own money at that point in time. So we believe in really making sure you reach out to all potential stakeholder groups, including the potential competing teams to make sure you get those targets right.

Somebody said earlier, you know, how do you put a big moonshot out there, a big, audacious goal and get the teams to compete, right? So you do that by understanding where the market is going in ten years and trying to make it go there in three years and you do it by supporting them.

So I think the best practices that we see in designing is really understanding the true market failures. As a doctor, you know, you don't—you want to cure the disease, not the symptoms, so you have to dig down. What are those market failures? Have a prize aligned with those market failures, make sure you are not presupposing a solution, and opening it up to the world.

Chairman BUCSHON. Thank you.

Mr. Wilson, what characteristics or key criteria for your winning your competition and what recommendations would you have to make competitors in the future—help them win competitions? I mean what were the—kind of the things that you all did to make yourselves successful in winning your competition?

Mr. WILSON. Well, I would like to go back to an earlier comment that when we looked at the competition we wanted to know is it put together well. Our industry is rather niche so we might see something that would be very strange, you know, recovery rates or speeds or something that would sort of derail our opportunity. So putting the effort into establishing a good contest, knowing the details, getting experts involved would be very important to us so that we know we are putting our best foot forward in a contest.

The other interesting part is when you do something this audacious, the general public is probably not going to believe you. If I just did this myself and could find somebody to actually publicize it, they would say, well, you guys are nuts. How did you do that? So when you have a contest, there is so much emphasis on the goal and the end result that everybody assumes that if you got there,

you certainly got there based on good performance. Those are characteristics that were important to us.

Chairman BUCSHON. So people that—competing for prizes should look into the quality of the prize and whether the organization offering it has the ability to hold a good competition. That is the bottom line it sounds like.

At this point I yield to Mr. Lipinski for five minutes.

Mr. LIPINSKI. Thank you, Mr. Chairman.

The first thing I want to ask, does anyone have any experience themselves or can anyone talk about what they have heard, what they have learned about any of the prize competitions that any agencies—federal agencies are doing? I was just wondering are there—is there anything that is not being done right now or you think should be done differently with the way these prize competitions have been done up to this point? Does anyone have any comments on that?

Mr. FRANGIONE. So I can't speak specifically about specific agencies or specific prizes. I think there is a couple key things that will make them be better, part of which was already talked about, marketing and media and recruiting teams.

Mr. LIPINSKI. Um-hum.

Mr. FRANGIONE. I think the other important thing is to not legislate a specific prize, right? You want to legislate the ability to do prizes and give them the tools—give the agencies the tools to do them in a consistent manner. But we want to make sure that we don't legislate a specific prize because, as I said, designing it—and as Donnie also said, designing it is really important. So if it is legislated that it has to meet these goals, those goals may be totally wrong.

And the other thing that is important for the agency is when they put out an RFP or an RFI to design a prize, they also have to recognize that they can't put the goals in the RFP and say you have to meet these goals if you design this prize because you want to be able to throw out those goals that you want to find the right prize to design.

So I think it is more—I think a lot of agencies are doing a really good job, NASA's Centennial Challenges, DOE has done a great job. I think it is more just knowing what other tools fit within the prize tool that could help them be more successful. So nobody is doing a bad job; they are just not taking full advantage of the prizes.

Mr. SINGH. Congressman, I would say there is a Yogi Berra quote that I like. It is "In theory there is no difference between theory and practice. In practice, there is." And it kind of applies to how things tend to work. For example, we have been very effective with running challenges with certain agencies. However, a lot of times the overall preparation, some of the things that Chris was describing, require us to then sometimes get in a situation where we have to contract with the government in a normal way, right?

And for us as a commercial organization, we don't focus on government as a sector. We look at the challenge as a way of saying this is a more efficient mechanism of engaging with government. But if we then get pulled into the rest of the cost-plus world of how things work, our tendency is to say, you know what, let's go look

for commercial customers or let's find some third party to try to deal with government for us. And so we end up in a situation where unless we have got really great support from an agency that is willing to navigate all sorts of rules for us, that we will choose not to enter and engage in that area because of the friction of the engagement.

Mr. LIPINSKI. Mr. Singh, you had talked about the—how you sort of—you separate bigger—you separate it into smaller pieces what you are trying to, you know, then pull together to come up with a solution to a problem. Is there—does the federal government—have you seen agencies doing that or could it be done better?

Mr. SINGH. Yes. So the challenge I described with NASA that we just launched around detecting asteroids, like who doesn't want to find asteroids? So that challenge is actually already broken down into 10 parts. And so the first three or four parts of that is to define the problem statement. We do kind of a test data set with the community so we make sure the problem is set up right. We break it down into certain components, and then the main event, so to speak, is like the sixth or seventh challenge along the way and then there is a refinement.

So we have done that pattern with NASA and the NASA Tournament Lab at HBS quite successfully. And they have actually gotten to where they understand how to break those down as well or better than we do now. And so it is a matter of—I think it gives us more surface area. It is not a way of discovering a new industry but it is certainly a way of exponential leaps forward in existing problem areas.

Mr. LIPINSKI. And are there areas that you think—Dr. Moe said that—you say you think this could be used better in healthcare. Are there areas that have not—other areas you think the federal government has not—federal agencies have not gotten into that they could use these prize competitions in? And are there areas that the federal government probably cannot serve a good role—that these prize competitions will not serve a good role in trying to solve?

Mr. SINGH. That is to me. So I think a couple things. Right now, the federal government is using prizes .0000001 percent, so there is a certainly opportunity for expansion without a doubt.

I think the key piece that I was saying is that I believe and what XPRIZE is doing with creating these large incentive pools. I think the micro challenges give you an opportunity to increase the surface area of the kinds of problems government can work on, so all of a sudden it is not just the exponential pieces but it is building applications, it is building things in order of magnitude cheaper or faster. And so it give you an opportunity to apply it in more places and I think that is a great complement.

There are certainly areas where this will never work, particularly where the data is too sensitive or there is information where it is so difficult to break the problem down that you can't do it. So there are limitations, but I think we are not even close to approaching those yet, so there is a lot of opportunity to expand and try this in other places.

Mr. LIPINSKI. All right. Thank you very much. I yield back.

Chairman BUCSHON. Thank you. I now recognize Mr. Massie, five minutes.

Mr. MASSIE. Thank you, Mr. Chairman.

I have got questions—I am sure this is well thought out, but I have questions about how intellectual property interweaves with some of these XPRIZES or prizes in general. So could you just give us a quick statement on that, Mr. Frangione, and then I have some questions specifically.

Mr. FRANGIONE. Sure. So in an XPRIZE competition, because we believe the teams are competing for the market at the end of the day, they are not competing for that check, we don't hold any of their IP, nor do our sponsors. And that is extremely important to us. First of all, we are 501(c)(3) nonprofit; we can't do it. But also we would see fewer and fewer teams compete if that is the case. And that is an important thing for the government to understand because often the government likes to hold the IP. And so you should look at more innovative ways of licensing IP versus holding it or saying, you know what, this is a challenge that is important enough. You keep your IP. Because again, if you keep their IP, they are competing for a \$10 million check and then you are not going to have as many competitors. They would rather compete for the multibillion-dollar market that is there at the end of the day.

Mr. MASSIE. So that might explain why we are getting 4 or 10 times as much—

Mr. FRANGIONE. Oh, absolutely.

Mr. MASSIE. —investment because—

Mr. FRANGIONE. Absolutely.

Mr. MASSIE. —all of the participants claim the right to their IP?

Mr. FRANGIONE. Sure. Right. So we are building the market that then they get to go enter into. They are helping us build it, but together we are building it.

Mr. MASSIE. So the prize just kind of puts them over the edge and sort of—it is not the straw that breaks the camel's back but it is the last little incentive that causes them to go after it?

Mr. FRANGIONE. Absolutely.

Mr. MASSIE. So—but if there is a \$10 million prize out there—and this is back to IP—so, for instance, a patent is not a right to do something; it is a right to exclude somebody from doing something.

Mr. FRANGIONE. Um-hum. Um-hum.

Mr. MASSIE. So to what extent can participants use in-house IP—which I assume that they could; I mean that would make sense—but if they are coming up with the XPRIZE, are they allowed to use other intellectual property from other portfolios? And do they have to license it as a condition of winning the prize—

Mr. FRANGIONE. So—

Mr. MASSIE. —or to win the prize?

Mr. FRANGIONE. So every team competing is its own company so they have to follow whatever rules any company has to follow to license technology or to build a new technology or to get a patent or license the patent, right? So that all sort of takes care of itself. We—you know, we make sure that our competitors follow all normal business rules, follow—you know, we can take competitors from around the world but we can't take any competitors that the

United States has sanctions against, right? So it is the same idea, right? They have to follow all their applicable business laws where they are located and where we are located.

Mr. MASSIE. But if they are going to use somebody else's goose that lays golden eggs, they have to license it?

Mr. FRANGIONE. Absolutely. Absolutely. And we see, interestingly enough, prizes are about competition but we see a lot of collaboration. In our Google Lunar, our \$30 million XPRIZE to land a lunar on the Moon, the teams are all merging, right, because they will say, oh, you have this technology and I don't have that so let's merge and compete as one team. And you see people jumping from other teams. So it is a really great model to not only get competition but—

Mr. MASSIE. It sounds like a great model, but as we start to understand it in Congress—

Mr. FRANGIONE. Yeah.

Mr. MASSIE. —and propose it as a—you know, the prize incentive as a way to direct research and to spend taxpayer dollars—

Mr. FRANGIONE. Right.

Mr. MASSIE. —ultimately, I am worried that the public won't appreciate that, that we are paying for somebody—giving them a prize and then the taxpayer doesn't necessarily hold rights to the intellectual property and the intellectual property is not public domain, although—

Mr. FRANGIONE. Right.

Mr. MASSIE. —I wouldn't argue—

Mr. FRANGIONE. Yes.

Mr. MASSIE. —that making it public domain is actually a good way to have it promoted. I think it is quite the opposite. But—

Mr. FRANGIONE. So you can—like I said, you can hold the IP, you can do most-favored nation pricing, you can do licensing. There are lots of ways you can get around that. We actually have a competition we are probably going to launch this year that the solutions are open source because we believe it is as important to the world. And the teams know going in that their solutions are going to be open source at the end. Great. So I think you shouldn't let that get in the way of encouraging agencies to use it because there is such a broad spectrum of what they can do with that IP and that licensing and you just have to find that sweet spot to maximize the number of competitors while also maximizing the benefit to the U.S. taxpayer.

Mr. MASSIE. Right. Because if there is no intellectual property protection, they are going to have a hard time getting the dollars to back the idea.

Mr. FRANGIONE. Exactly.

Mr. MASSIE. Final question for anybody that wants to answer, are there any problems that our federal government faces where you say, gee, they need to do a prize there and they could—we could solve that? Yes, Dr. Moe.

Dr. MOE. Clearly, kidney disease is a major burden and—

Mr. MASSIE. Okay.

Dr. MOE. —the key is is that dialysis—I mean you could break it down. You could do so many different prizes. You can do an implantable kidney. You could even just take the current dialysis

procedure where you have needles going into an access that often fails, you have water system problems, you have hydrodynamics, you have filters, so you have membranes that need experiments, you could add cells to those membranes. And here, yet, we have done nothing in 25 years. We are still putting needles in, taking blood out, running it through a filter. I mean we have to do something like that and it is a perfect, perfect item. We are there from technology, we are there from the science level, we understand the kidney. Anything can be better than what we are doing now.

Mr. MASSIE. I will put that on my list. My time is expired but I would love to hear the other answers to that question.

Chairman BUCSHON. Yeah. That is true. I have taken care of many, many end-stage renal patients and they—no one knew in the 1970s when they first developed dialysis that it would—it was only supposed to be for a few people, right? Nobody knew that the technology would advance and suddenly that is why people are all on the Medicare program because it was so expensive but nobody knew it would explode into what it is today—at such a big cost to the government and to the patients.

With that, I recognize Ms. Kelly, five minutes.

Ms. KELLY. Thank you, Mr. Chair, and welcome.

Mr. Frangione and Mr. Singh, engagement in STEM education is critical for the future competitiveness of our Nation. Many experts have testified before this committee and said that success in the STEM fields must start at an early age and be seen as something achievable for all students. How have or might your organizations use prize competitions as a tool to promote STEM education and to engage diverse groups of students in STEM?

Mr. SINGH. Thank you, Congressman, for the question.

So obviously for us it is the supply chain of our future, right, not just as a country, as a company overall. And so a few things that we do to promote growth overall that we are looking to extend into the areas that we run challenges for free on a weekly basis that draw 2 or 3,000 competitors. They take about 90 minutes. There are some code challenges. And they compete for readings and they compete for learning. Like people are trying to get better. So these are not for paid prizes but we invest in creating these so they are like applied challenges.

So one of the things that we have done is we have run those in special ways for high school or college competitions as well. Later this year we will be making it self-service so any high school or college computer science teacher can go and say, hey, let me run my own virtual competition against our databank of 2,000 problems that have been accumulated over the past dozen years. So that is some of the things that we will go through and do. That really addresses though the, I would say, post-“I have learned to code,” for example, stage. We are not—that we are not any further out. But it is really effective.

I was at a high school technology conference called TechOlympics in Cincinnati. It is one of the largest high school competitions in the country, and we ran a mini [topcoder] tournament for the kids there. And it was exciting to see the winners and the like, and one of the things that really struck me with the computer science teacher is he was like, you know, we have to teach for a certain

band and this is an area that has so much spectrum of beginner to advanced that no curriculum in my school can cover all my students. So this is such a great opportunity for me to really be able to shuffle those people who got a spark or interest in it to be able to give them a way of learning and finding an outlet for their creativity regardless of how old they are or where they sit.

So those are some of the things that we are looking at. I think there is a lot more that we could do. One of the particular pieces for us is girls in STEM. Last year, we did a poster design contest for how to encourage girls in STEM at a young age. I think that is an area that we would like to invest and do more in in the future.

Ms. KELLY. Thank you.

Mr. FRANGIONE. And so at XPRIZE we are trying to create the next Apollo moment, right? And hopefully that in amongst itself is going to excite kids into STEM education. But we recognize that is not, right, so we have these giant competitions out there to get us to the next Apollo moment but we spend a lot of time and effort getting kids involved either through smaller competitions like FIRST Robotics or other competitions that we support. We do a lot of documentaries. We just created a dome show for planetariums focused on the Moon and our Google Lunar XPRIZE.

So our goal is to get kids really excited at a very young age, getting them in smaller competitions that they can then, you know, compete on, and we—but what we are realizing is—and it is great. We used to have these smaller competitions, and we still do, but we now have high school teams competing for our \$10 million competitions. So it is almost like, okay, I guess we are going to go to 13-month-olds, right, with our stuff because the eighth graders are going to start competing for our competitions next. So we focus a lot on the STEM education and we really want to get people excited and kids excited about science because they are our future and we need them to be excited.

Ms. KELLY. Thank you so much. I don't know if Mr. Wilson or Dr. Moe have a comment.

Dr. MOE. Yeah. I think one of the things to keep in mind, too, is that we have shortages of various types of physicians in the country, and particularly nephrology is facing a true workforce challenge, lack of interest in our field. And kids today are very technological, far more than I certainly was going through medical school. I wanted the physiology. Kids today want to apply that physiology to technology, and I think that is where prize competitions to get those integrated is really important.

We offer a course for first-year medical student at Mount Desert Island to go through physiology and I would love to add a little bit of technology to that where we can—here, here is what the kidney does. What if you could create a chip that actually puts these pieces together? And people are doing that. People are actually working on the kidney on a chip.

Ms. KELLY. I don't know if you have any comments.

Thank you. I yield back.

Chairman BUCSHON. Thank you.

I recognize Mr. Johnson from Ohio, five minutes.

Mr. JOHNSON. Thank you, Mr. Chairman. And by the way, I have got young grandchildren. I have got a 13-month-old that is already using an iPad, so there might be some value in that. I don't know.

For all of you, though, in light of ongoing budget pressure and our current state of fiscal austerity, how can prize competitions conducted by the private and public sectors serve as an efficient and effective tool for spurring innovative solutions to advance high-tech industries? Now, I know this is kind of a 30,000 foot view, but for my first entry at the Committee, I want to understand—I want to get your perspective on that. I think it is important but I want to hear why you think it is important.

Mr. FRANGIONE. Sure. So the key to prize competitions, as you heard briefly, is that they push all the risk onto the teams so you can use a small amount of money—a small amount of government money—and you have to support them, right. There are operating costs. You can use a small amount of money to push the risk onto the teams so that these folks are developing technologies and solutions to achieve your goal.

And in doing so, those teams are spending significantly more than that prize purse. The example I gave in my testimony is you could give out a \$5 million grant and get \$5 million worth of work or you can put out a \$5 million prize and we see in our prize competition anywhere from 4 to 10 times leverage. So you are going to get \$20–50 million worth of work. When you are talking about fiscal constraint, that is amazing.

If you look back over history, the Lindbergh prize was a \$25,000 prize and all the teams spent \$400,000. And our Ansari XPRIZE, the \$10 million prize, there are 27 teams from—or 26 teams from seven nations, spent over \$100 million. And the winning team actually spent \$26 million to win \$10 million. We don't see that a lot but we do see that big number a lot. So they are great tools specifically for that reason.

Mr. JOHNSON. Okay. Any of the rest of you? Dr. Moe.

Dr. MOE. Sorry. For healthcare in particular and for dialysis, because of the way the reimbursement system is set up, there is—it is not a disincentive but there isn't an incentive to actually do innovation. And I think by having a prize, that kind of goes outside of the main reimbursement system, outside of the main way that we do business actually is a way to jumpstart that. In particular, I mean a dialysis patient—dialysis itself is very, very expensive but these patients are sick, they are hospitalized, they are on over 30 pills a day, they are on Medicare Part D. They also require surgeries and so their cost is beyond just the procedure. And so even if we can fix one of those problems with a prize, we can actually impact long-term cost to the government with a minor investment compared to the \$35 billion we spent annually.

Mr. JOHNSON. Sure. Mr. Singh, you have a comment?

Mr. SINGH. I was going to say I think it works because markets work. And what we have shown the last dozen years because of technology is it went from where you had done something to do something to where you need access. And so, for example, if you are fans of hotels or car services, Uber and Airbnb are companies that have hundreds of thousands of units of capacity that they

don't own, but because of technology, they allow you to get to. And what this created is the opportunity for leverage.

And so today what one person, what 10 people can do is tremendously transformed because of what technology has done. And with prizes, you allow that supply and demand of talent to find each other and you get the opportunity for the market to work in an even broader way. And so I think that applies to every industry.

Mr. JOHNSON. What about on an efficiency spectrum? You know, we talk about the need for empowering American workers and American businesses to compete on a level playing field. Competition demands that companies are effective, that they are efficient in their operations. How do you think these science prizes like this sponsored by the federal government, does that encourage marketplace efficiency?

Mr. SINGH. I mean from my perspective, absolutely, right? I mean I think there is obviously the two edges to that equation, right? It requires investment in kind of core skills. We talked about STEM. We have to have the raw materials that enable us to be the most efficient in those areas, but absolutely, it is actually ruthlessly efficient, right? It works and rewards the best outcome, and that is something that in general can save a lot of money but also requires that we arm ourselves with the right tools to be able to participate in that kind of marketplace.

Mr. JOHNSON. Again, all of you, do you think we have too many of these federally funded science prize programs, too few? I think I know what your answer is but—

Dr. MOE. Few.

Mr. JOHNSON. Okay. Mr. Chairman, I yield back three seconds.

Chairman BUCSHON. Thank you for that extra time.

I now recognize Mr. Kilmer for five minutes.

Mr. KILMER. Thank you, Mr. Chairman.

First of all, thank you all for being here. I think this is—has a huge upside, a tremendous opportunity to drive innovation and to appeal to talented people to come up with good solutions.

I will throw in just in response to Mr. Massie's question. I know we have been speaking with the XPRIZE folks and others about looking at using that—this model and working with NOAA to provide a prize competition around addressing the ocean acidification, which in my neck of the woods is a very big deal that affects our shellfish industry and others, sort of similar to the one Wendy Schmidt XPRIZE ocean health prize competition.

A lot of the questions that I had have been asked. I guess I am curious just from a public policy standpoint if you can provide some direction to us. You know, it seems like the role for Congress kind of could fit a few areas. 1) you know, in terms of funding, kind of be encouraging, authorizing, appropriating for the purposes of prizes; 2) trying to establish some method of coordination as agencies are sort of contemplating doing prizes, have some sort of coordinating mechanism to make sure that it is done right and that they are not sort of reinventing the wheel when each agency contemplates this; and then 3) there is, you know, obviously sort of directing it. You know, go do a prize on this or that or, you know, ocean acidification or something else.

Am I missing anything big? And then as you look at those sorts of levers, any advice if I airdropped you into Congress as to how best to approach those ways of engaging?

Mr. FRANGIONE. Sure. So I will take that and then I will pass it off.

And funding is great. We always like more funding to the agencies to do prizes and helping to clarify what they can do and what they can't do and how they can do it. So, for example, I mentioned earlier we really believe you need to support the teams and you need to market and educate the public and the world and the teams. And so giving them that ability to use every element of a prize to make that prize most effective is extremely helpful.

We also are in favor of directing to certain areas. We are not in favor of legislating specific metrics of prizes. That is when you get into big trouble because you end up possibly picking metrics that aren't the best metrics.

As Donnie said earlier, you know, he really looked at the metrics of the competition to see if it was worthwhile. And there is an art and science to prize design and you need to allow the agencies and the public and private sector partners to design that in the appropriate manner.

So I think you have got them all. I would just caution on how you direct the types of prizes.

Mr. KILMER. Thank you.

Mr. FRANGIONE. Um-hum.

Mr. SINGH. So I don't—I am not a public policy expert but I will act like the government is a really big company, which I do know how to deal with, okay. And so what we tell really big companies is we say, look, you need to create some centers of excellence that allow for skills to be there but you don't want to throttle all work through that because—

Mr. KILMER. Yeah.

Mr. SINGH. —even big companies are too big for things to go through one central location. So centers of excellence that allow you to cluster experience and knowledge sharing are important but you certainly don't want to throttle things through that.

The other piece that we sometimes give advice to large companies is create incentives for people who do things well, right? So if agency—and this—in your context, if agency X does something well that receives an exponential return, well, guess what? You get to do more of that. And so what that does is it creates the incentive and behavior where somebody says, oh, it spreads around. We did something; it receives this return. That led to this positive outcome. And now I want to go to the center of excellence and learn. So if that process is emulatable in the government context, that is a something that has worked for large organizations looking to absorb new innovations.

Dr. MOE. I think one of the things that can be done is to identify really problem areas. Obviously dialysis is one of those. But I think within those agencies, as part of the ASN, go and talk to individuals within CMS, for example, there is recognition that there is not enough innovation. There is recognition that the current payment structure is for the purpose of containing cost but doesn't do anything to reduce cost and improve innovation.

So within those agencies, there is recognition of the need for something new and different, and by, you know, doing a prize within your various offices of who can come up with the best idea for a prize competition or best needed area would be a way to spur people to think about it. I think that is the important thing is to somehow encourage offices to think about a prize.

Mr. KILMER. Thank you. And to give 10 more seconds, I yield back. Thank you. I did better than three.

Chairman BUCSHON. There you go.

I recognize Mr. Hultgren for five minutes.

Mr. HULTGREN. Thank you, Mr. Chairman. Thank you all for being here. This really is a crucial hearing for this Subcommittee as we continue to ensure federal government is playing a smart role in advancing innovation and breakthrough discoveries that I believe will dramatically change our world and make it a better world to live in.

Prizes are an important mechanism where private sector partners such as yours certainly can have a dramatic effect. I also believe the federal government should be learning best practices from you as the administrators have approached prizes in a very different manner, having more numerous but smaller prizes that often serve mainly PR purposes. It is also important they understand how prizes work together with our greater federal R&D enterprise, and they both play crucial roles in a symbiotic relationship.

Mr. Frangione, is that it? Sorry. Frangione. Is your written testimony—in your written testimony you touched on the multiplier effect these prizes have on R&D. Teams, I think you stated, spend 4 to 10 times the value of the prize in aggregate. Why do you think XPRIZE has been successful in getting people to spend more than a prize purse to win the prize? Is it simply the prestige of winning the prize? Also, how do you build prize branding so that there is prestige in winning your prize and thereby attract a diverse group of participants?

Mr. FRANGIONE. So there are a lot of reasons teams compete for our prizes. One is the prize purse obviously. Two is the legitimization of an industry. Nobody believed that private companies could put a plane in space. Only government could do that. And our prize legitimized that. And as Donnie said earlier, one of the other things is you can first go out there and you can market your result and say I have done this but nobody believes it because your company is marketing it. When you go through a prize competition, the prize has all these different stages whether it is independent third-party verified data that they can now use to make the products better and to go out and sell their product.

Another real reason teams compete is for the competition resources. When we used Ohmsett where the oil spill cleanup XCHALLENGE was held, that cost us \$1 million to rent the facility and \$1 million in donated oil. We had 10 finalist teams so it is \$200,000 per team and it was on a U.S. Navy base so you wouldn't have been able to use it anyway. So they got to test at an independent third-party verified testing center because of the competition. So the key is and the reason we are successful is that we provide lots of reasons for the team to compete that is not about that

check. Once it is about that check, you are not going to get a lot of teams competing. So you have to make it rewarding and simple for them to compete. You have to make sure that they are all heroes so that they all compete for that end market at the end of the day. Once you limit it to a \$10 million check, nobody is going to compete. Well, you will have a few but not a lot.

Mr. HULTGREN. Do you think it is more difficult for the government to build similar branding when we have so many different and smaller prizes?

Mr. FRANGIONE. I do not. I think the government can do a great job in this and many have. NASA's Centennial Challenges are doing great. USAID is investigating prizes and doing a fantastic job. I think the key is that you have to pull all these other levers in the prize—the marketing, the media, the competition resources—and make them rewarding for teams to compete.

I think people would be excited to compete for a government prize, right? I mean XPRIZE is a great brand but I actually think it would be cooler to compete for a NASA prize. People at home will kill me for saying that but, you know, it is—NASA holds so much more stature than we do, right? So I think the government's brands that they have—USAID, NASA, DOE—are big enough amongst themselves and I do encourage them to do much larger prizes than they are currently doing.

Mr. HULTGREN. I don't know if you want to put the Congress brand on—I don't know how that would go over.

Let me touch on again the multiplier effect these prizes have. I wonder if you could give the Committee any examples of companies that competed for prizes, did not win, but still started successful businesses from their work. In your testimony you spoke about "disruptive innovation" and "democratizing innovation." How does your process give previously overlooked teams both the experience and exposure they need to then enact a workable business model and attract private capital?

Mr. FRANGIONE. Sure. So for us we have lots of examples of—and I can't give you specifics just because I don't know them off the top of my head, but we have lots of examples of teams going out and competing. We just have so many teams it is hard to keep track. For example, on our oil spill technology prize, we had a team that was a tattoo artist and they came in seventh place. They didn't win any money but they still did better than industry standard at the time on one of the metrics and they are out there competing in the marketplace. Unfortunately, I don't know how successful they are. Maybe Donnie knows how successful they are now. But still, they would have never competed. They didn't even have an interest in the industry until the prize existed.

So the key is that you don't know who the solver community is until you launch the prize, and that is why they are so much better than a traditional grant or contract in certain places. Basic research where there is no end market, prizes don't work. You need that end market. But in certain places where there is a big end market, prizes work really well.

Mr. HULTGREN. Well, thank you all very much. I guess I have only three seconds that I can yield back like my colleague from Ohio. So I yield back, Chairman.

Chairman BUCSHON. Thank you very much.

At this point I would like to thank all the witnesses. This is a very fascinating hearing. I thank you for your valuable testimony and the Members for questions. The record will remain open for two weeks for additional comments and written questions from Members.

The witnesses are excused and the hearing is adjourned. Thank you very much.

[Whereupon, at 11:19 a.m., the Subcommittee was adjourned.]

